



**SR-73 1085L
GSRD with Sediment Trap**

**Operations, Maintenance, and Monitoring Plan
Monitoring Season 2002 – 2003
January 2003**

**State of California
Department of Transportation**

CTSW-RT-03-030

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Section 1

Project Overview

1.1 Project Background

The Transportation Corridor Agencies (TCA) designed and constructed the San Joaquin Hills Transportation Corridor Toll Road, State Route 73 (SR-73). The purpose of this project is to replace the existing Compost Storm Water Filter (CSF) System at Basin 1085L along SR-73.

1.2 BMP Selection

The replacement storm water Best Management Practice (BMP) identified for Basin 1085L is a Gross Solids Removal Device (GSRD) with a Sediment Trap. The existing CSF System is contained within a concrete vault that has interior dimensions 20.2 m by 7.4 m (L x W). A reverse sloping screen (RSS) has been constructed into the concrete vault. The purpose of the RSS is to confine gross solids into the upstream area of the concrete vault. The term “gross solids” includes: litter; vegetation; and other solids such as sand, soil, and gravel. The *Guidance for Monitoring Storm Water Litter* (Caltrans, 2000a) defines litter in storm water as “manufactured items made from paper, plastic, cardboard, glass, metal, etc. that can be retained by a 5 mm (0.25 in nominal) mesh screen.” In addition, the existing concrete vault is large enough to detain the Water Quality Volume (WQV). As a result, the concrete vault will also act as a sediment trap.

1.3 Project Objectives

The goals of the project are to:

- Document the amount of gross solids captured by the GSRD with Sediment Trap located in Caltrans District 12.
- Assess the effectiveness of the GSRD with Sediment Trap in reducing gross solids from highway runoff.

Section 2

Scope of O&M Plan

This Operations and Maintenance Plan (OMP) describes the operations and monitoring of gross solids at the SR-73, Basin 1085L. Gross solids will be visually monitored at the site during and after storm events, or every four weeks if no rain occurs. Inspections during storm events will be conducted a maximum of three times during the storm season. Post storm inspections will be conducted a maximum of eight times.

Accumulated gross solids will be removed during the season as necessary, and at the conclusion of the storm season. Measurements will be taken of the gross solids mass and volume.

Section 3

Project Organization and Responsibilities

This project is being conducted under the direction of Kuen Tsay, Caltrans Headquarters Environmental. Technical assistance is being provided by David Alderete, Office of Water Programs, California State University Sacramento (CSUS). Camp Dresser & McKee Inc. (CDM) is managing the project from its Ontario Office, under the direction of Luis León.

Monitoring, maintenance, and inspection of the site will be conducted by CDM, Southern California. Field teams will conduct all field data acquisition work.

Section 4

Monitoring Location

The site selected for monitoring is one of 39 existing CSF systems along SR-73. The Basin 1085L is being retrofitted with a GSRD with Sediment Trap. The site is located adjacent to the southbound SR-73 off ramp to Bonita Canyon Drive (KP 36.2) as shown in Figure 4-1. Site characteristics are listed below in Table 4-1. Figure 4-2 shows a schematic drawing of the GSRD with Sediment Trap.

Table 4-1
Summary of Monitoring Site Characteristics – Basin 1085L

Site Characteristics	Basin 1085L
Caltrans District	12
Regional Water Quality Control Board	Santa Ana (Region 8)
Highway	SR-73 Southbound
Kilometer Post	36.2
Longitude	W 117° 50' 35"
Latitude	N 33° 37' 55"
Catchment Area - ha (ac)	1.01 (2.5)

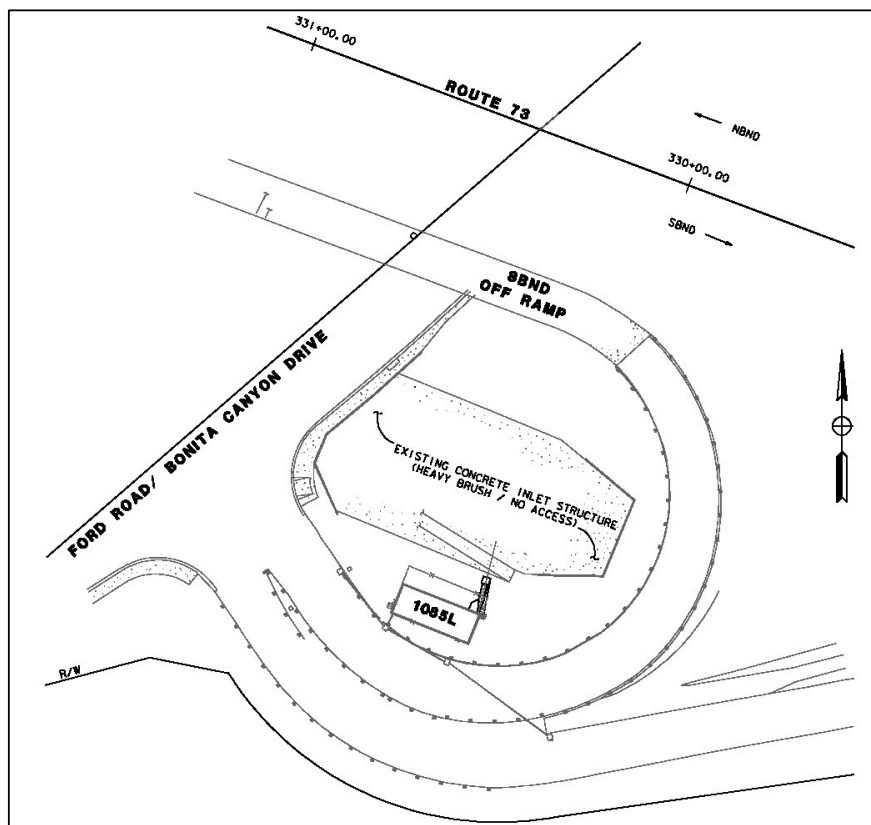


Figure 4-1
Site Location Map – SR-73/1085L GSRD with Sediment Trap

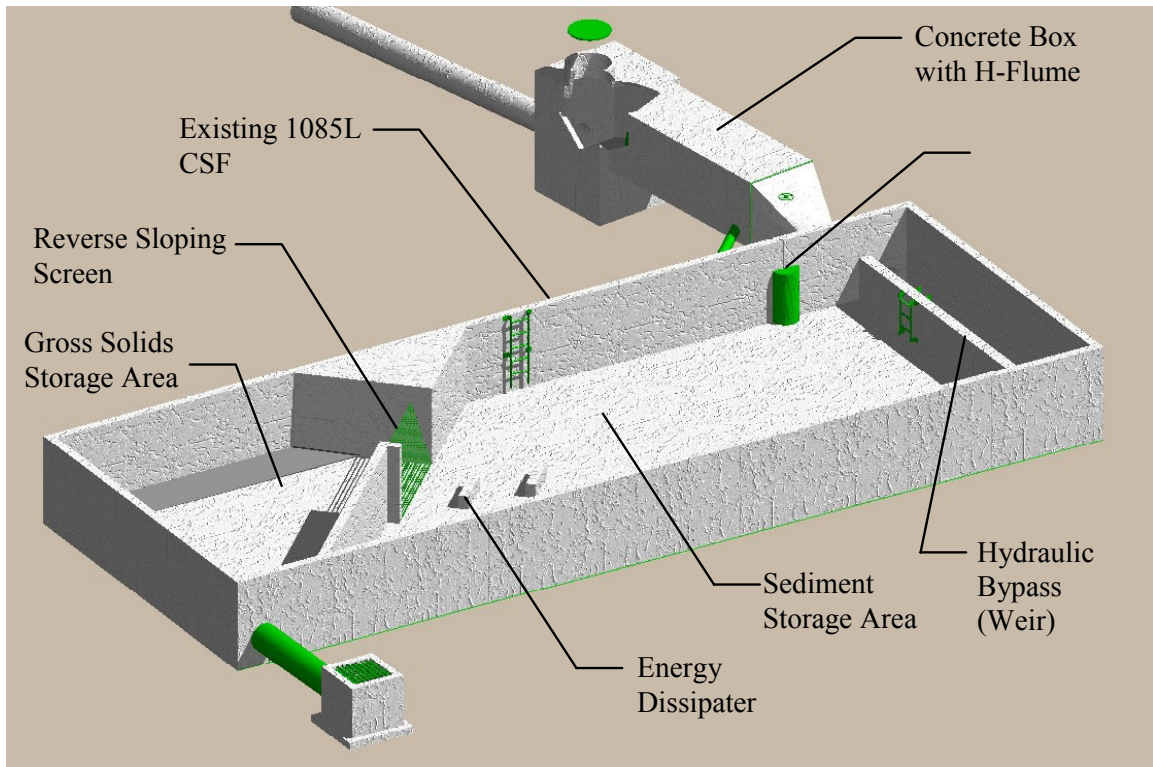


Figure 4-2
Schematic – SR-73/1085L GSRD with Sediment Trap

Section 5

Gross Solids Monitoring

Throughout the monitoring season, the site will be observed and after each storm event, certain information will be recorded. At the end of the season, the accumulated gross solids will be collected and weighed, and volume will be measured.

5.1 Post Storm Event Inspection

The program will involve post-storm event field inspections. Field inspections will be conducted at the site within 72 hours after every rain event of 13 mm (0.5 in) or greater during the rainy season (October 1, 2002 – May 1, 2003), or every four weeks if no rain occurs, except for Blackout Dates listed in Section 5.4. Field inspections will be conducted for a maximum of eight rain events.

The inspections will consist of making visual observations of the amount of gross solids collected in the GSRD and sediment trap; noting any obvious obstructions to the hydraulic capability of the RSS; verifying that the GSRD and sediment trap are properly draining following rain events; and observing conditions related to site security (e.g., fences in place, gates locked, and no graffiti on the device). At each inspection at the site, field crews will:

- Fill out standard field data collection forms.
- Take photographs of site conditions and accumulations of gross solids.
- Assess screens for clogging.
- Verify that GSRD and sediment trap is draining properly and no standing water is present.
- Note any odors that are present.
- Note obvious obstructions to the hydraulic capacity of the RSS.
- Note estimated amount of gross solids accumulation in the GSRD and the sediment trap.
- Note observations related to site security.
- Prepare a summary report for and apprise Caltrans of maintenance issues.

The device will be cleaned during a post storm event inspection when the RSS appears to be clogged or when evidence of overflowing is observed. Cleaning of the GRSD with Sediment Trap, and the collection, weighing, and estimation of gross solids volume captured in the device shall be in accordance with Section 5.3.

5.2 Storm Event Gross Solids Inspection

Inspections during selected storm events will be conducted a maximum of three times throughout the rainy season (October 1, 2002 – May 1, 2003) except during Blackout Dates. The threshold for mobilization for storm event inspections is set at 13 mm (0.50 in) minimum of forecasted rain. Field crews will not mobilize unless at least 13 mm (0.50 in) of rain is forecast with a minimum of 50 percent probability, and it has started raining at locations near the site. Furthermore, storm event inspections will be conducted only during daylight hours and will be no more than two hours in duration.

In addition to the field tasks discussed in Section 5.1, storm event inspections include the following:

- Coordinate with weather service to track approaching storm events.
- Mobilize one 2-person field crew when the weather forecast indicates the chance for rain is 50 percent or greater for a storm of at least 13 mm (0.50 in) and it has started raining.
- Document the performance of the GSRD with Sediment Trap for up to two hours during selected storm events.
- Depending on weather conditions, take digital photos at the site during the selected storm events.
- Prepare post-storm event inspection reports for the site within 7 days of the end of each storm event inspection.

5.3 Gross Solids Removal and Data Collection

The GSRD with Sediment Trap will be cleaned and all accumulated gross solids removed from the device after the end of the rainy season (May 1, 2003), or if necessary during the season when the device appears to be clogged or has evidence of overflowing (see Section 5.1). Each cleaning will include field measurements. Cleaning and data collection tasks include:

- Manually clear all gross solids from the GSRD screen, sediment trap outlet, and all hardware.
- Manually remove the accumulated gross solids from the GSRD and sediment trap. Prior to transferring the gross solids to plastic trash bags, they should be gravity drained for at least two minutes or until they are substantially drained of free water (e.g., no drips for 5 to 10 seconds). Place all gross solids into plastic trash bags. Each bag should be loaded to a maximum of approximately 70 Kg (150 lbs) to allow two people to be able to lift the bag and place it on the scale, and to load it into a vehicle for disposal off the highway right-of-way. Note that the bags may be heavy

and a mechanical winch or boom truck may be necessary for safe handling and transport.

- Perform field measurements of the weight of the materials collected. (Note: Does not include sorting of vegetative and non-vegetative materials). Each of the gross solids bags will be placed on a scale and weighed separately. All recorded weights shall have an accuracy of 0.1 Kg (0.2 lbs). Field crews will use a Siltec WS200L scale to weigh the gross solids. The scale has a maximum capacity of 90 Kg (200 lbs) and accuracy of 0.1 Kg (0.2 lbs). Weight measurements from all bags will be added together and the total weight calculated.
- Perform field measurements of the volume of the materials collected (Note: Does not include sorting of vegetative and non-vegetative materials). The volume of gross solids will be estimated by placing the bags of gross solids (one at a time) into a container of known volume. The bag should be made as level as possible across the entire surface area of the container. The amount of freeboard should then be measured and multiplied by the surface area of the container to obtain the remaining volume. This quantity will then be subtracted from the total known volume of the container to yield the estimated volume of gross solids. Field volume measurements from all bags will be added together and the total volume calculated.
- Dispose removed gross solids off the highway right-of-way and according to Caltrans specifications.
- Enter data into the project database; litter weight and volume results, and site information.

All data obtained from interim cleanings (if applicable) shall be added to the final cleaning data at the end of the storm season.

5.4 Inspection Blackout Dates

All monitoring operations, including storm watch and fieldwork, will be suspended on the following black out dates. Black out dates will commence at 5:00 p.m. on the Caltrans construction work day immediately proceeding a legal holiday (Standard Specifications 1-1.255) and will continue through 8:00 a.m. on the Caltrans construction work day immediately following the legal holiday, and at other times when directed by Caltrans. Inspections will not be performed on Thanksgiving Day (November 28), the day after Thanksgiving Day (November 29), Christmas Eve through Christmas Day (December 24, 25), and New Year's Eve through New Year's Day (December 31, January 1). As discussed in Section 5.2, inspections during storm events will be conducted only during daylight hours.

5.5 Notification Procedure

The contact list (Figure 5-1) shows the lines of communication and notification responsibilities for the monitoring project; it shows pertinent telephone numbers for each person involved in the project. Emergency telephone numbers are also listed, including the number for the hospital nearest the monitoring stations. The contact list is used for gross solids monitoring preparation activities, communications during monitoring, and coordinating demobilization activities following a monitored event.

Figure 5-1
Contact List

Caltrans Personnel Kuen Tsay (HQ) (916) 653-5240 o (916) 653-6366 f David Alderete (916) 278-8104 o (CSUS OWP) (916) 549-7384 c	Field Coordinator Shaun Stone (CDM) (909) 945-3000 o (909) 762-0750 c
Task Manager Luis León (CDM) (909) 945-3000 o (909) 762-0759 c Shaun Stone (CDM) Assistant Task Manager (909) 945-3000 o (909) 762-0750 c (909) 945-1333 f	Field Crew Stephen Liao (909) 945-3000 o (909) 762-0755 c Wilfred Hsu (909) 945-3000 o (909) 762-0757 c Allyson Chu (909) 945-3000 o (909) 762-0748 c Philip Bogdanoff (909) 945-3000 o (909) 762-0756 c Rick Kern (909) 945-3000 o (909) 762-0752 c
Forecasters: National Weather Service (916) 979-3051	
Emergency: 911 Hospitals <u>Hospital</u> College Hospital, closest, 24hrs, non-emergency (949) 642-2734 Irvine Medical Center, 24hrs, emergency (949) 753-2000	KEY o = office c = cellular f = fax h = home p = pager v = voice mail

5.6 Data Quality Objectives

To provide scientifically defensible data in fulfillment of program objectives discussed in Section 1, data quality objectives are used to establish acceptable measures of data quality. The data quality objectives for this project include procedures for measuring weight and estimating volume of gross solids. As discussed in Section 5.3, gross solids mass and volume data obtained should be accurate to the nearest 0.1 Kg (0.2 lbs) and 0.01 m³ (0.35 ft³).

Section 6

Health and Safety

Health and safety procedures that have been established for the Caltrans – SR-73 1085L Gross Solids Monitoring Project will be followed at all times. These procedures are presented in the document, *Caltrans SR-73 1085L GSRD with Sediment Trap Gross Solids Monitoring Program Health and Safety Plan*. A copy of the plan is located in Appendix A. Each field team member will receive a copy to review prior to the start of the monitoring project. A copy will always accompany each crew out in the field.

Several general procedures that will be followed at all times include:

- All field personnel must wear hard hats, traffic vests, and steel-toed boots when working outside the vehicle.
- Traffic control must be set up before conducting any work in the Caltrans right-of-way where personnel will be exposed to traffic. Standard traffic control measures include parking vehicles to shield personnel from traffic and using hazard lights.
- No field personnel will enter the GSRD with Sediment Trap, manholes or storm pipes without submitting a confined-space entry permit with CDM. Confined space entry procedures are included in the Health and Safety Plan.
- Clean nitrile gloves will be worn by all field crewmembers when working with gross solids.
- Cell phones use will be avoided or minimized while driving.

Section 7

Data Management and Reporting

Weight and volume data for this project must follow the data validation procedures outlined in Section 13 of the *Guidance Manual: Stormwater Monitoring Protocols* (Caltrans, 2000b). Additionally, electronic and hardcopy data must be filed in an organized and easily accessible fashion. Weight and Volume data must be reported in the format consistent with the Caltrans Stormwater Management Program database. See *Storm Water Monitoring and Research Program 2002-2003 Litter Data – Reporting Protocols* (Caltrans, 2002) for data reporting guidance.

Section 8

References

Caltrans, 2000a. California Department of Transportation [Caltrans]. Guidance for Monitoring Storm Water Litter. October 2000. CTSW-RT-00-025.

Caltrans, 2000b. California Department of Transportation Environmental Program. 2000. Guidance Manual: Stormwater Monitoring Protocols (CTSW-RT-00-005). July 2000.

Caltrans, 2002. California Department of Transportation, Environmental Program 2002. 2002-2003 Litter Data – Reporting Protocols, December 2002.

Appendix A

HEALTH AND SAFETY PLAN



**SR-73 1085L
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**Health and Safety Plan
Monitoring Season 2002 – 2003
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<i>Attachment 3</i>	Monitoring Site Specific Safety Information Sheets
<i>Attachment 4</i>	Camp Dresser & McKee Inc. Confined Space Entry Procedures
<i>Attachment 5</i>	Caltrans Maintenance Manual Chapter 8 – Protection of Workers

Section 1

Introduction

This Health and Safety Plan (HSP) identifies the health and safety procedures for work to be conducted for the Caltrans SR-73 1085L GSRD with Sediment Trap Gross Solids Removal Study. This includes field monitoring activities and periodic maintenance of the device as required. Implementation of this plan is the responsibility of the CDM Project Managers. The Site Safety Officer assists the CDM Project Managers in carrying out this responsibility at the work site by enforcing the requirements of the Health and Safety Plan and by the authority to suspend work to protect worker health and safety. Either the Site Safety Officer or the Project Health and Safety Officer may suspend or limit work, or direct changes in work practices, if the HSP and/or work practices used are deemed inadequate.

This HSP may not be used for work other than that described in Section 4.0. This plan is to be followed by all CDM personnel and CDM's subcontractors who will be participating in the monitoring program. All personnel included in the monitoring program shall be responsible for reading this plan and following its procedures.

CDM and CDM's subcontractors will share responsibility for providing health and safety management. This includes joint planning, management, site control, reporting and problem solving. Each employer is also responsible for its employees in accordance with the employer's own health and safety policies.

Section 2

Project Health and Safety Personnel

2.1 Project and Safety Personnel

This section identifies key project health and safety personnel involved in the Caltrans SR-73 1085L GSRD with Sediment Trap Gross Solids Removal Study. This outline presents the names, titles, and specific responsibilities of these individuals in terms of project health and safety.

Personnel

Title	Name	Number
Corporate Health and Safety Officer	Chris Marlowe	(732) 590 - 4632 (732) 539-8128

Responsibilities

- Overall health and safety advisor.
- Interface with CDM personnel, subcontractors and Caltrans' project managers in matters of health and safety.
- Review, approve or disapprove project Health and Safety Plans.
- Monitor compliance with Health and Safety Plans.

Title	Name	Number
Study Task Manager	Shaun Stone	(909) 945-3000 (909) 762-0750

Responsibilities

- Assure that the project is performed in a manner consistent with the CDM Health and Safety Program.
- Assure that the project Health and Safety Plan is prepared, approved, and properly implemented.
- Implement Health and Safety Plan.
- Assure that adequate project resources are allocated to fully implement the project HSP.
- Assure compliance with the Health and Safety Plan by contractor personnel.
- Coordinate with the Corporate Health and Safety Officer on Health and Safety matters.

Title	Name	Number
Site Safety Officer	Rick Kern	(909) 945-3000 (909) 762-0752

Responsibilities

- Direct health and safety activities on-site.
- Report all safety-related incident or accidents to the Corporate Health and Safety Officer and project manager.
- Assist project manager in all aspects of implementing Health and Safety Plan.
- Maintain health and safety equipment on-site.
- Implement emergency procedures as required.
- Conduct health and safety investigations and briefings as needed.

Section 3

Site Information

One GSRD with Sediment Trap has been installed in Caltrans District 12 (see vicinity map in Attachment 1 at the end of this document).

The general safety considerations associated with inspection and maintenance at the sites include: traffic hazards, confined spaces, biological hazards, exposure to hazardous materials, limited visibility, fast moving flood waters, heat stress, exposure to cold or freezing temperatures, slippery conditions, and maintenance activities conducted by Caltrans.

Section 4

Work Activities Covered by Health and Safety Plan

The objective of this project is to monitor the amount of gross solids captured by the GSRD with Sediment Trap and to assess the effectiveness of the GSRD in reducing gross solids from highway runoff. The majority of the fieldwork will consist of crews inspecting the sites and making field observations in response storm events. In addition, some fieldwork will be directed toward maintenance that would occur during dry conditions; and annual collection of gross solids.

Field activities at all the monitoring sites will include inspection (before, during, and after storm events) and general maintenance activities (on going). The hazards associated with all work performed at sampling stations include: (1) being involved in a vehicle accident while driving to or from a site, (2) being struck by a vehicle while working at a site, (3) confined space accidents, (4) experiencing heat and cold stress, (5) being exposed to hazardous materials or vapors, (6) slips, trips, and falls, (7) muscle strains from moving heavy objects, and exposure to biological hazards including rats, dogs, and black widows.

Most inspection and maintenance procedures at the sites will not require entry into confined spaces. Confined spaces have limited openings for entry and exit, unfavorable natural ventilation which could contain or produce dangerous air contaminants, and are not intended for continuous employee occupancy. All CDM employees and CDM subcontractors who enter a confined space during this project must have had confined-space entry training and a confined-space entry permit as required by the Division Health and Safety Officer.

Site inspection in response to storm events will be performed by CDM staff and CDM subcontractors. This will involve one or more visits per site during storm events. It is anticipated that one field crew consisting of two people will be adequate for this site. The general tasks performed by a crew visiting any given site will consist of: (1) driving to the site, (2) establishing traffic control (if needed), (3) inspecting the performance of the device, (4) taking pictures, and (5) removing traffic controls and proceeding to the next site. These activities do not require entry into the portion of the drainage system that is underground.

Section 5

Hazard Assessment

5.1 Chemical Hazards

Although the monitoring sites are not known to contain hazardous materials, there is a potential for hazardous gaseous and/or liquid contaminants to be present as the result of spills and/or illicit dumping. The presence of chemicals and/or chemical vapors may result in (but is not limited to) one or more of the following threats: toxic conditions, oxygen displacement and explosion and/or fire. The risks associated with these threats include poisoning (acute and/or chronic), asphyxiation, and bodily injury.

5.2 Confined Spaces

The U.S. Occupational Safety and Health Administration (OSHA) classify storm sewers as confined spaces. Regulations for entry into confined spaces are provided in the OSHA Confined Space Standard [Title 29 Code of Federal Regulations (CFR) 1910.146] and in Section 5157 of Cal OSHA CCR 8. The risks associated with confined spaces include dangerous atmospheres, engulfment, falls, falling objects, and bodily harm due to explosion. Confined Space Operating Procedures to be used during this project are presented in Section 7.5.

5.2.1 Atmospheric Hazards

Atmospheric hazards that may be present within the storm sewers include oxygen deficiency and toxic or flammable gases. More sewer workers die each year from atmospheric causes than from all other causes combined. Each potential hazard and the recommended evaluation method is presented below:

Oxygen deficiency: Oxygen (O₂) deficiency can be caused by the aerobic decomposition of sewage and organic matter. Chemical and biological processes during the decomposition use the available oxygen. Oxygen deficient atmospheres can also result from displacement by gas such as methane or hydrogen sulfide which may or may not be harmful but cannot support life. Oxygen deficiency may be present in areas with little ventilation or air circulation or where biological or chemical processes are occurring. A confined space where water or sewage is enclosed for long periods, and where extensive oxidation of iron (rust) occurs has a high potential for being oxygen deficient.

The normal level of oxygen in the atmosphere is 20.8%. Levels between 19.5% and 20.7% are considered potentially hazardous. An atmosphere legally oxygen deficient contains less than 19.5% oxygen. An atmosphere containing less than 16% oxygen is considered immediately dangerous to life and health (IDLH).

Symptoms of oxygen deficiency include shortness of breath, dizziness, impaired vision, and loss of consciousness.

Hydrogen Sulfide: Hydrogen sulfide (H_2S) is a dense, colorless gas that is the byproduct of sewage and organic material that has anaerobically decayed. It has the characteristic odor of rotten eggs. Initially, effects of the gas anesthetize the sense of smell, and cannot be detected by odor only. Hydrogen sulfide prevents the bonding of oxygen to the hemoglobin molecule contained in the blood cells. Paralysis of the respiratory system is followed by unconsciousness and possibly death.

The eight-hour time-weighted average (TWA) permissible exposure limit (PEL) is 10 ppm. The 15-minute short-term exposure limit (STEL) is 15 ppm. The IDLH concentration is 300 ppm.

Symptoms of hydrogen sulfide poisoning include inflammation of the eyes and lungs, dizziness, loss of coordination, weakness, breathing difficulty, loss of consciousness, and cessation of breathing.

Hydrogen sulfide is often present as a dissolved gas in sewage or can be trapped within sewer sediment and sludge. Disturbing the sediment or sludge can release the trapped or dissolved gas.

Carbon Monoxide: Carbon monoxide (CO) is a colorless, odorless gas that acts as a chemical asphyxiant. It is lighter than air and accumulates beneath manhole covers. It is a product of almost any kind of combustion or hydrocarbon oxidation.

The eight-hour time-weighted average (TWA) permissible exposure limit (PEL) is 35 parts per million (ppm). The 15-minute short-term exposure limit (STEL) is 200 ppm. The IDLH concentration is 1500 ppm.

Symptoms of exposure include headache, dizziness, nausea, weakness, and confusion. In addition the skin becomes cherry red in color.

Methane: Methane (CH_4) is a colorless, odorless gas that is lighter than air. It is produced by the chemical decomposition of sewage and organic matter. The gas tends to accumulate beneath manhole covers. Methane is both an asphyxiant and explosive. The lower explosive limit is reached when the concentration of methane reaches 5% of the total atmospheric composition.

Petroleum Hydrocarbons: Petroleum hydrocarbon vapors may enter storm drains as a result of spills or vehicle accidents. If gasoline or diesel fuel odors are present and/or an oily sheen is observed on the water surface within the confined space, employees should leave that space immediately.

5.3 Physical Hazards

5.3.1 Open Vaults

Open vaults pose a threat to workers and general public. Limited visibility, inattention, poor site control, slips, and/or trips could result in person falling into the vault. The risk associated with such a fall could be bodily injury. The GSRD's are open basins with hazards similar to an open vault. During maintenance activities, caution should be exercised when working on or around the device.

5.3.2 Vehicle Traffic

Traffic hazards will be encountered when working at the side of or in a roadway. These hazards will be increased during times of reduced visibility such as during storm events and at night. The primary threats associated with working in or alongside roadways are workers being struck by passing vehicles or being involved in a vehicular collision. The risk associated with these threats is severe bodily injury and/or death.

5.4 Cold and Heat Stress

Hazards associated with the outside environment will be encountered when working at the monitoring sites. The primary threats associated with working outside are either cold or warm temperatures. These hazards will increase during times of freezing or near freezing temperatures, rainy conditions, and high levels of physical activity. The threats associated with these hazards are developing hypothermia, heat stress, and frostbite. The risks associated with these threats are decrease in mental capacity, bodily injury and/or death.

5.5 Biological Hazards

Rodents, pathogenic microorganisms, and viruses are potential biological hazards of concern. In addition, a significant potential exists for contact with, and bites from, poisonous brown recluse spiders or black widow spiders when crews open the enclosures during a storm event, particularly when lighting is poor. The primary threats associated with these hazards are receiving bites and/or contracting disease. The threats associated with these hazards include flesh wounds and/or infections (acute and/or chronic).

Section 6

General Health and Safety Requirements

6.1 Employee Clearance

When CDM personnel and CDM subcontractors are directly involved in confined space entry activities, a minimum of two employees with an active safety and health clearance status will be present. Active health and safety clearance will consist of a confined space health and safety course approved by the person's employer. The Confined Space Entry Program (CSEP) that applies to any such entry will be that of the employer whose employees actually enter the space. All other field personnel involved in field and/or storm water sampling activities must receive training from the Site Safety Officer before conducting field work.

6.2 Site Safety Meetings

All personnel assigned to perform the work described in this HSP must be (1) given a personal copy of this HSP by a Site Safety Officer, (2) briefed on the health and safety requirements of this HSP by a Site Safety Officer, and (3) must acknowledge receipt of and willingness to comply with the provisions of the plan by signing the Employee Acknowledgment located in Attachment 2. Individuals refusing to sign the agreement will not be permitted to conduct field work for this project. Completed agreements shall be provided to the CDM Project Manager, who will file them with the Project Health and Safety Officer. It is expected that site safety meetings be conducted on two occasions: (1) at a project kick-off meeting to discuss the overall program and (2) just after the crew is mobilized for sampling. Additional briefings should be scheduled and conducted by the Site Safety Officer as needed.

6.3 Incident Reporting

6.3.1 Purpose

All health and safety incidents shall be reported to CDM management and health and safety staff immediately. The prompt investigation and reporting of incidents will reduce the risk of future incidents, better protect all employees, and reduce CDM liability.

6.3.2 Definitions

A health and safety incident is any event listed below:

- Illness resulting from chemical exposure or suspected chemical exposure.
- Physical injury, including both those that do and do not require medical attention to CDM employees or CDM subcontractors.
- Fire, explosions, and flashes resulting from activities performed by CDM and its subcontractors.

- Property damage resulting from activities performed by CDM and its subcontractors.
- Vehicular accidents occurring on-site, while traveling to and from client locations, or with any company-owned vehicle.
- Infractions of safety rules and requirements.
- Uncontrolled chemical exposures.
- Complaints from the public regarding CDM field operations.

6.3.3 Reporting Procedures

Reporting Format

Incident reports shall be prepared by completing an Incident Report Form. This form may be obtained from any CDM Health and Safety Officer and is located in Attachment 2.

Responsible Party

Reports of incidents occurring in the field shall be prepared by the Site Safety Officer or, in the absence of the Site Safety Officer, the supervising field engineer, witness, or injured/exposed individual.

Filing

A report must be submitted to the Health and Safety Officer of the Operating Unit to which the CDM Project Manager belongs within 24 hours of each incident involving medical treatment. In turn, the Health and Safety Officer must distribute copies of the report to the Corporate Health and Safety Officer. When an injury or illness is reported, the Health and Safety Officer must deliver a copy of the report to the individual in charge of Human Resources so that a Worker's Compensation Insurance Report can be filed if necessary. Reports must be received by Human Resources within 48 hours of each qualifying incident.

Major Incidents

Incidents that include fatalities, hospitalization of employees or subcontractors, or involve injury/illness of the public shall be reported to the Health and Safety Officer and CDM Project Manager as soon as possible after emergency authorities (e.g. ambulance) are contacted. Any contact with the media should be referred to the CDM Project Manager and Operating Unit Manager.

6.4 Prohibited On-site Activities

The following are prohibited on-site activities: (1) entering confined spaces without specific training, (2) conducting inspection or maintenance without clearance from the Site Safety Officer, (3) eating and drinking without prior decontaminating (e.g., washing hands and face), and (4) smoking. Violations of these prohibitions will result in dismissal from the field crew.

Section 7

Site Specific Health and Safety Requirements

7.1 Special Medical Tests

Special medical tests will not be required for any of the work activities proposed in this plan.

7.2 Special Training

Confined space entry requires specific training. Under no circumstances will personnel be allowed to enter a confined space without training approved by their employer.

7.3 Physical Hazards

7.3.1 Manhole Lids and Open Vaults

The manhole lid is lifted using a crowbar wedged into the side cutout. At no time during the opening, moving, or closing of the lid should hands be placed under the lid. CDM employees might review the manhole opening guidelines at http://cdmweb/healthsafety/manhole_covers.doc.

Opening the lid at the manhole creates a new hazard. A fall into the open manhole may result in serious injury. The area around an open manhole may need to be cordoned off from the general public by using barricades and/or traffic cones. All field crewmembers must be informed before the manhole is opened. Each sampling crew will keep access control equipment (cones, barriers and tape) in its sampling crew vehicle throughout the duration of the project.

7.3.2 Work Site and Traffic Control

Work site control and work zones will be established each time a crew visits a sampling station. Field crews will use traffic control cones, warning signs, and vehicles to develop work zones and site control at sites where the safety of crews and the public may be threatened. An example of this would be the use of traffic cones to direct pedestrians away from an open manhole where vehicle traffic control is not required. Site specific protocols for proper vehicle and traffic safety in relation to a given sampling station are provided in Attachment 3. Actual field conditions may require modification of the directions. Modifications, if any, will be made by the Site Safety Officer who will then inform the Project Health and Safety Officer.

Traffic hazards pose the greatest risk to workers visiting sampling stations.

Traffic hazards to both workers and motorists must be minimized at each sampling station. Standard traffic control measures, which can be used to reduce traffic hazards, are described below. However, sampling sites may be located in areas where standard traffic measures may not be applicable. In these cases, standard control measures will be modified to meet a given situation.

Warning signs (i.e., Utility Work Ahead, Lane Closed, etc.) shall be erected on the roadway or shoulder and shall be removed upon termination of work. Portable signs shall be erected vertically, with the bottom of the sign a minimum of 18 inches above the roadway. Portable signs shall be illuminated at night and/or be accompanied by a flashing yellow light. Traffic cones or pylons shall be placed on the roadway to divert traffic away from the manhole opening. These cones must have reflective striping in order to be visible at night. The cone taper distance from the manhole shall be determined by the following equation when speed limit is 40 MPH or less:

$$L = (WS^2)/60$$

where L = pylon taper length in feet
W = width of desired closure or offset (feet)
S = posted speed limit (miles per hour)

(Adopted from Manual on Uniform Traffic Control Devices, Chapter 6H, 1988)

Table 7-1 shows taper lengths for various traffic speeds with 5 and 10 foot wide lane closure. A lane closure pertains only to traffic lanes and does not include shoulders other areas outside the main traffic flow. The site plans have been developed with these criteria.

Table 7-1 Traffic Cone Taper Lengths		
Width of Closure (feet)	Traffic Speeds (mph)	Cone Taper Length (feet)
5	25	52
	30	75
	35	102
	40	133
10	25	104
	30	150
	35	204

Employees should not rely on traffic warning devices, like cones or saw-horses, for protection against oncoming traffic. CDM encourages work teams to place one or more vehicles between them and the direction from which traffic flows.

7.4 Hazardous Materials Identification and Protection

Storm water and storm water sewer systems have some potential to contain hazardous materials and/or microorganisms and should be approached with caution. Industrial and commercial areas are of particular concern because of possible illegal dumping of wastes into the storm sewer system. Any unusual smells and/or discolored sample water are definitely cause for alarm. The following procedures are recommended to help protect field personnel from these hazards:

- If field crews detect or suspect any dangerous situations they must notify the Site Safety Officer of their intended protective procedures.
- Field personnel should wear chemically resistant gloves when handling gross solids samples. It is important to realize that storm water can contain dangerous constituents regardless of land use type. For example, storm water typically has high concentrations of bacteria. All crew members who come into contact with storm water must decontaminate when they complete the day's field work. This is especially important prior to eating and drinking or smoking. All personnel must also decontaminate before leaving the site. Proper decontamination techniques will ensure that contamination will not spread to vehicles or other locations. Decontamination should include disposal of gloves and washing the hands and face with soap and water. Each crew shall carry 5-gallon containers containing wash/drinking water and antibacterial wipes or lotion. All crew members must be careful to not contaminate the container.

7.5 Confined Space Standard Operating Procedure

Storm sewers are defined by OSHA as confined spaces and are therefore subject to federal regulation. Each employer providing personnel for confined space entry will have its own written CSEP. A copy of this program will be submitted to the HSO prior to the start of work. All CDM employees will comply with CDM's confined space entry requirements and procedures, which are included in Attachment 4. All CDM subcontractors will comply with their confined space entry requirements and procedures.

The anticipated level of hazard will determine procedures for entries as defined below.

Low Hazard Entries

Definition: Includes any storm water system where there is clearly no potential for connection to a sewer system, and the storm water system is dry. Note: the presence of mud at the bottom of a channel is evidence that the system is not dry. Similarly, storm drains with a submerged discharge to a river are not dry. Under dry conditions, no potential for exposure to volatile contaminants is anticipated. Entries must be completed when there is no precipitation forecasted.

Procedure: Use 4-gas meter to monitor all levels of the space. Verify that the instrument has been calibrated to alarm at the action level, and document all readings. If explosive levels are below 10% of the LEL, oxygen content is between 19.5% and 22%, hydrogen sulfide is less than 5 ppm, and carbon monoxide concentrations are below 15 ppm, and no other hazards are anticipated, entry may proceed. No CSE permit is required. Fall protection is required for all entries with a

vertical drop of greater than 6 feet. A ladder may be used in place of fall protection only if it is in full compliance with the OSHA standard.

Moderate Hazard Entries

Definition: Includes any storm water system where there is clearly no potential for connection to a sewer system, but the system contains liquids, and therefore may contain unknown volatile contaminants. Entries must be completed when no precipitation is forecasted.

Procedure: The standard confined space entry form will be used for approval and termination of entry. Emergency communications and use of an attendant will be required. Fall protection requirements will be the same as the low hazard entry. The space must be ventilated prior to and during entry. Entries into these spaces by CDM personnel require prior completion of the CDM permit form and approval by a CDM confined space entry coordinator.

High Hazard Entries

Definition: This includes sewers, entries when there is a potential for precipitation and any entries where additional hazards are anticipated.

Procedure: The confined space entry standards must be fully implemented. The CDM Project HSO will coordinate with the project manager to prepare the entry permit.

It is very important to notify all members of the field crew when hazardous situations are encountered. In general, the notification process will consist of notifying the Site Safety Officer. This individual, will in turn, notify higher levels of CDM management. However, if the Site Safety Officer is not available the CDM Project Manager must be contacted.

7.6 Biological Hazards

Field crews must protect themselves from biological hazards they may be exposed to during sampling activities. Bacteria and other micro-organisms may potentially be present in collected storm water samples. Crews should protect themselves by using disposable nitrile or latex gloves when handling storm water samples. Crews should also avoid hand to mouth and hand to eye contact until they have had a chance to wash their hands. Eating and drinking will not be allowed until proper decontamination has occurred.

There is also the possibility of exposure to either wild or domestic animals. Crews should avoid these animals since they may carry rabies or other diseases and they are capable of inflicting serious wounds.

7.7 Environmental Hazards

Field crews must protect themselves from hazards associated with environmental conditions, such as cold temperatures, heat stress, and rain. Crews should protect themselves from heat stress by avoiding work during the hottest part of the day, drinking plenty of water, resting frequently, wearing light breathable clothes, and wearing a hat. When working during periods of cold temperatures (below 10 degrees Centigrade), crew members should dress in layers of warm clothing, avoid keeping their hands and head exposed for long periods of time, minimize the time spent outside of protected areas. When working during periods of rain, crewmembers should wear waterproof clothing and boots to avoid getting their underclothes wet. At the first signs of becoming overheated or very cold, crewmembers should seek shelter until their body temperature returns to near normal.

7.8 Personal Protective Equipment

Protective equipment shall be used and shall consist of the following:

- Hardhat
- Reflective safety vest
- Rubber boots with steel toes (when needed)
- Rain Gear (when needed)
- Cold weather gear such as hat, gloves, boots, coat, pants (when needed)
- Nitrile or latex gloves
- Splash proof goggles (if desired)

In addition, a first aid kit will be present in each vehicle used for field work. It is the responsibility of field crew leaders to be sure their vehicles have a first aid kit and cellular telephone before entering the field.

Section 8

Emergency Response Procedures and Location of Nearest Hospitals and Fire Departments

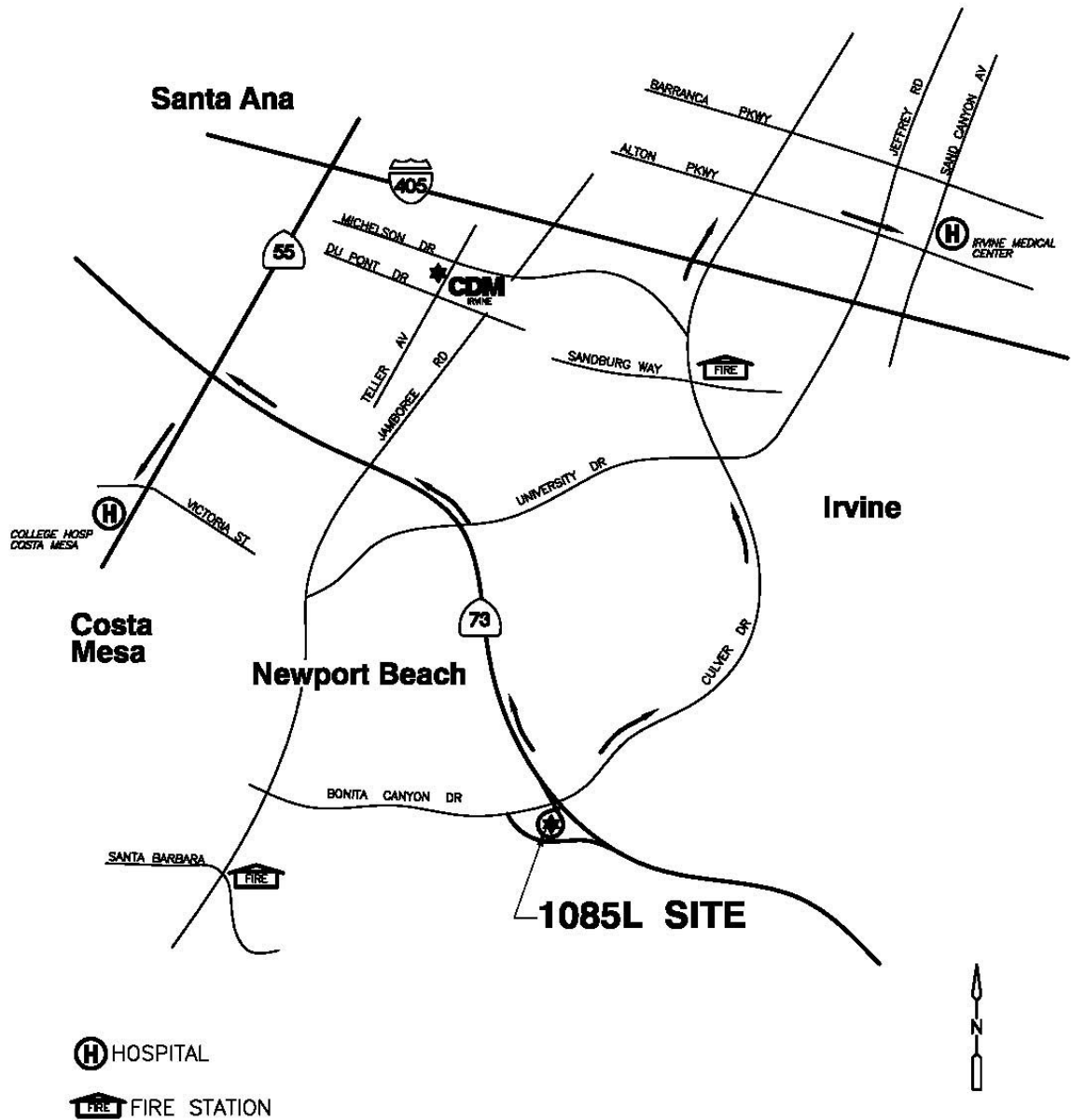
In the event of an injury, illness, or accident that may require the attention of a physician, the Site Safety Officer(s) must be notified immediately. In the event of emergency, the CDM Task Order Manager and the CDM Project Corporate Health and Safety Officer will also be notified immediately:

- CDM Task Order Managers: Shaun Stone (909) 945-3000
(909)-762-0750 (cell)
- CDM Corporate H&S Officer: Chris Marlowe (732) 590-4632
(732) 539-8128 (cell)

If a person(s) is transported to a medical facility, the location of this facility must be given to the Site Safety Officer. In emergency situations, field personnel should call 911 for an emergency response team. All CDM employees and subcontractors must be familiar with the location of and route to the nearest hospital. Location maps and routes to local hospitals and fire departments are provided in Attachment 1 and must be carried in the field vehicle at all times.

Table 8-1 Site and Hospital Locations				
Monitoring Site	Hospital Location	Hospital Phone Number	Fire Department Location	Phone Number
SR-73, 1085L	College Hospital 301 Victoria Street Costa Mesa, CA 92627 24 hrs, non-emergency	949-642-2734	See Attachment 1	911
	Irvine Medical Center 16200 Sand Canyon Ave. Irvine, CA 92618 24 hrs, emergency	949-753-2000		

Attachment 1
Vicinity Map and Emergency Service
Location Maps



Attachment 2
Employee Acknowledgement
Injury / Illness Report

Employee Acknowledgment

(Please sign, detach and return to CDM Project Manager)

I hereby certify that I have read and understand the safety and health guidelines contained in Caltrans SR-73 1085L GSRD with Sediment Trap Gross Solids Removal Study Health and Safety Plan.

Employee Name

Signature

Date

In case of emergency, please contact:

1.

Name

Relationship

Phone Number

2.

Name

Relationship

Phone Number

Received by:

Site Safety Officer

Signature

Date

CDM Employee Injury or Exposure Incident Report

EMPLOYEE DATA:

Name	_____	Business Unit	_____
Address	_____	Office Location	_____
	_____	Occupation	_____
Home Phone	_____	Marital Status	_____
Soc. Sec. #	_____	Date of Hire	_____
Birth Date	_____	Date of Report	_____

INJURY/ILLNESS INFORMATION:

Location of Incident	Office	Field	Public Space	Plant
Site Name and Address	_____			

Operation in Process	_____			
INCIDENT TYPE:	Exposure	()	Injury	()
	Possible Exposure	()	Near Miss	()
Date of Incident:	_____			
Time of Incident:	_____			

SOURCE OF HAZARD OR HARM (e.g. Machine, Auger, Car, Chemical Substance)

INJURED OBJECT OR BODY PART (e.g. Arm, Leg, Lungs, Shoe, Crew Vehicle)

NATURE OF LOSS (e.g. Cut, Burn, Fracture, Headache, Property Damage)

DESCRIBE HOW INJURY/ILLNESS OCCURRED (e.g. Struck by...Fell from...Exposed to...)

SITE CONDITIONS AT TIME INCIDENT:

Temperature	_____	Humidity	_____
-------------	-------	----------	-------

Wind Speed & Direction

Cloud Cover

Precipitation

Other

Physician Name and Address

Hospital Name and Address

MEDICAL CARE RECEIVED (*when, where, by whom*):

PHYSICIAN'S COMMENTS: (*Attach Physicians' Report(s), if any*).

HAS INCIDENT RESULTED IN:

Loss of Work Time ()

If Yes, Enter Below (Actual or Anticipated):

Number of Days Lost

Date of Return to Work

Death ()

Permanent Disability ()

Temporary Disability ()

Property Damage ()

Other Type of Loss ()

Explain:

HEALTH AND SAFETY ISSUES (If applicable)

MATERIALS EXPOSED TO (*chemical compound name, physical state, etc.*):

OTHER INDIVIDUAL(S) INVOLVED OR AFFECTED:

WITNESSES TO THE INCIDENT:

WAS OPERATION SUBJECT TO AN APPROVED SAFETY PLAN OR PERMIT?

YES () Reference _____

NO () Explain _____

WAS INJURY/ILLNESS/EXPOSURE DUE TO FAILURE OF PROTECTIVE EQUIPMENT?

YES () NO () Explain _____

POSSIBLE CAUSES OF INJURY OR EXPOSURE:

HAS HSM BEEN NOTIFIED?

NO ()

YES ()

Employee Signature

Date

HSM COMMENTS:

ACTION REQUIRED:

Attachment 3
Monitoring Site Specific
Safety Information Sheets

CDM Site Safety Inspection

Project: SR-73, 1085L GSRD with Sediment Trap Gross Solids Removal Studies

Location: Southbound SR-73 at Bonita Canyon Drive

Basin 1085L

Activities

Inspection, maintenance, and collection of gross solids using manual techniques.

Site Description

Facility/Parking – The monitoring/maintenance crew will park in the Caltrans right of way within the southbound SR-73, Bonita Canyon Drive loop off ramp. The site is behind continuous k-rail so no traffic control is required.

Safety Hazards and Recommendations

- Entering the facility from the off ramp by making a right turn before reaching Bonita Canyon Drive. To leave the site, watch for cars coming down the loop off ramp before making a right turn back onto the off ramp.
- There is a concrete channel with heavy vegetation to the north of the site. Field crews should not access the channel at any time for any reason.
- The GSRD and sediment trap will fill with water during a storm event and become a drowning hazard.
- The lid on the downstream manhole is extremely heavy. Always use two crew-members to move the lid.
- Ladders are installed for access into the GSRD and sediment trap for installation and maintenance work. Always use caution when climbing up or down the ladders.
- Poisonous spiders and other vermin inhabit these areas; be aware and use gloves when possible.
- Always wear hardhats, steel toed boots, and safety vests.

Attachment 4
Camp Dresser & McKee Inc.
Confined Space Entry Procedures

CDM

CONFINED - SPACE

ENTRY PROCEDURES

April 10, 2003

CDM CONFINED-SPACE ENTRY PROCEDURES**April 10, 2003****PURPOSE**

This program establishes requirements for safe entry into, work in, and exit from, confined spaces such as wet wells, manholes, tanks and vessels, or pipelines. Camp Dresser & McKee (CDM) employees or subcontractors may enter a confined space only when these confined space entry procedures are followed.

Confined spaces are dangerous because gases and vapors can accumulate to form oxygen deficient, explosive, or toxic atmospheres. Although CDM can't place signs on spaces belonging to its clients, entry into the following is considered confined-space entry (CSE) unless these procedures provide otherwise.

Tanks	Vessels
Manholes	Pipelines
Water transmission lines	Tunnels
Stilling wells	Junction structures
Valve and metering vaults	Un-ventilated dry wells
Limited-access wet wells	Sewers

Some confined spaces may or may not require a permit, depending on the circumstances. CDM treats trenches, vaults, pits, or diked areas as confined if they pose a potential for trapping a toxic atmosphere. Only operating unit CSE coordinators may determine that work in such a space does not need a permit. A dry well or pipe gallery that becomes hazardous only when a pipe ruptures is an example of a space to which the CSE Coordinator might decide these procedures do not apply.

When the air in the space presents no hazard, and the physical hazards can be controlled without entry, employees may, with coordinator approval, use the low-hazard entry permit described later in this procedure. The types of space in which this procedure will probably apply include; clear wells, sedimentation basins, equalization basins, rapid mix tanks, flocculation tanks, sand filters, and water plant clarifiers. Although employees who have not completed CDM's confined space entry course may perform a low - hazard entry, at least one employee with the training should have seen the space and reviewed the permit.

DEFINITIONS

1. Confined Space For our purposes, a Confined Space is an enclosed space which:
 1. Is large enough and configured such that an employee can bodily enter and perform assigned work, **and**
 2. Has limited or restricted means of entry or exit, **and**
 3. Is not designed for continuous employee occupancy.
2. Permit-required Confined Space Confined Spaces are permit-required when they have one or more of the following characteristics;
 - a) Contains or has a known potential to contain a hazardous atmosphere, **or**
 - b) Contains a material that can engulf an entrant, **or**
 - 3) Has a configuration that could trap or asphyxiate an entrant, **or**
 - d) Contains any other recognized serious safety or health hazard.
3. Emergency. Any occurrence (including any failure of hazard control or monitoring equipment) or event(s) internal or external to the confined space which could endanger entrants.
4. Engulfment. The surrounding and effective capture of a person by a liquid or finely divided solid substance.
5. Entry. The act by which a person intentionally passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and occurs when any part of the entrant's body breaks the plane of an opening into the space.
6. Hot Work. Operations which could provide a source of ignition, such as riveting, welding, cutting, burning, or heating.
7. Immediately Dangerous to Life or Health (IDLH). Any condition which poses an immediate threat of loss of life; may result in irreversible or immediate-severe health effects; may result in eye damage; irritation or other conditions which could impair escape from the confined space.
8. Inerting. Rendering the atmosphere of a confined space nonflammable, non-explosive or otherwise chemically non-reactive by such means as displacing or diluting the original atmosphere with a gas that is non-reactive with that space.

9. Isolation. The process by which a confined space is completely protected from the release of energy or material. Isolation is usually accomplished by such means as blanking or blinding; removal or mis-alignment of pipe sections or spool pieces; double block and bleed; or lock-out and/or tag-out.
10. Limited or Restricted Means of Entry or Exit exist when the entry occurs while crawling, through a manhole, by a ladder, or on a rope. Entries on grade, through doorways, or on stairways that meet OSHA standards are not restricted.
11. Not Designed for Continuous Employee Occupancy. Spaces which are designed for filling with liquids or solids or contaminated air. Most spaces with continuously operating ventilation and lights are designed for human occupancy.
12. Oxygen Deficient Atmosphere. An atmosphere containing less than 19.5 percent oxygen by volume.
- I. Oxygen Enriched Atmosphere. An atmosphere containing more than 22 percent oxygen by volume.

PROGRAM SUMMARY

No CDM employee may enter a confined space unless these procedures (or equivalent procedures approved by the coordinator) are followed. CDM's CSE program includes:

- ☐ Training for confined-space team members.
- ☐ Medical clearance and immunization.
- ☐ Preparation and review of pre-entry permits.
- ☐ Required appropriate safety equipment.
- ☐ Subcontractor accountability
- ☐ Monitoring for hazardous conditions.
- ☐ Standard operating procedures for entries.
- ☐ Ventilation of hazardous gases.
- ☐ Rescue procedures and equipment.
- ☐ Annual review of CSE permits and program.

Once a year, or more often as needed, CDM's Health and Safety Managers will review the canceled permits and address any problems that have been observed since the last review.

CDM work teams who perform entries at client facilities shall coordinate their schedule and entry procedures with the client if its employees could be affected by the entry. They shall also offer to explain our procedures to the client.

Although client and subcontractor personnel may participate with CDM personnel in a confined-space entry, this program is for the protection of CDM employees. Clients and subcontractors may use these procedures only if they accept all liability for their use. CDM subcontracts that require non-CDM personnel to enter confined spaces in the absence of CDM employees should include CDM=s protocol for confined space entries by subcontractors (Available from Health and safety group.)

ROLES AND RESPONSIBILITIES

Unless the CSE coordinator determines that liquids or gases are neither present in nor can enter the space during the work period, entry by team members requires--at a minimum--people who fill three roles:

Entry Attendant(s) Confined-Space Entrant(s) Rescuer(s)

CDM achieves confined-space safety principally through a detailed plan of cooperation between team personnel in the roles listed in table 1, below.

TABLE 1 ENTRY TEAM REQUIREMENTS

Position	Qualification
CSE Coordinator	A CDM employee, trained and authorized by the corporate H&S officer to sign and issue entry permits. The current CSE Coordinators are listed in Attachment E.
Entry Supervisor	An entry team member trained and authorized to certify that entry permit conditions have been met.
Confined-Space Entrant	Entry team members who are trained to perform actual work in confined space.
Entry Attendant	A team member outside the confined space who monitors conditions inside and outside of the space.
Rescuers	Stand-by personnel who respond to emergencies in confined spaces.

CDM employees may fill these roles only when their operating unit's H&S manager determines that they are qualified. Team members must possess valid immunization for any disease (for example, tetanus or hepatitis) that the H&S group, with the advice of CDM's medical consultant, determines are appropriate for the space. The personnel who fill these roles must have completed the training and passed the examination required by these procedures. The division will keep a written record of the length and content of such training.

Team members who do not work for CDM may fill the on-site roles, if they meet the requirements. A CDM construction inspector, for example, may enter a space while a general contractor's employee serves as the entry attendant, if that employee 1) has completed training equivalent to that shown in this program and 2) can fully perform the attendant's role. Only CSE coordinators may evaluate the CSE programs of other organizations.

The persons who fill the roles described above shall perform the tasks described below:

The **CSE Coordinator** shall;

- X Provide advice to project personnel on the applicability of this procedure to their projects.
- X Review confined space entry permits for completeness and appropriate controls. Approve (or disapprove) them in a timely manner that facilitates project work.
- X Consider waiving the permit if potential entry of materials or energy represents the only reason to consider a space permit - required and the space has been completely isolated.

The **Project Manager** shall

- X Evaluate every work space to determine whether it is confined.
- X Contact the local coordinator to discuss the potential hazards of each confined space that CDM or subcontractor personnel will enter.

The **Entry Supervisor** shall:

- o Learn about the hazards of the space, and the materials in it, and how to recognize the signs and symptoms of exposure to any toxic materials in the space.
- o Assure that the pre-entry check list on the permit is complete and that conditions are acceptable before any employee enters a confined space and while the employee is in the space.

- o Perform air monitoring as required by the permit.
- o Verify that the rescue worker is available and establish communications for summoning him or her.
- o Immediately terminate the entry when a non-permitted condition occurs.
- o Sign the entry permit to authorize entry.

The Entry Supervisor may serve as an entrant or an attendant in accordance with the following requirements specified below.

The **Entry Attendant** must:

- o Learn about the hazards of the space, the materials in it, and the signs and symptoms of exposure to any toxic materials in the space.
- o Read and understand the permit.
- o Remain outside the confined space, immediately available, and in communication with entrants (the attendant may perform tasks in addition to those listed below during entries, as long as he or she never loses track of an entrant's location and condition).
- o Leave only when replaced by an equally qualified individual or to save his or her own life. If the attendant must leave and there is no replacement, order the entrants to exit the confined space.
- o Stay continuously aware of the location and condition of all authorized entrants within the confined space by voice, radio, visual observation, or other equally effective means.
- o Stay continuously aware of conditions in the space.
- o Order entrants to exit the confined space at the first indication of hazardous condition (such as instrument alarms, visible releases, or unusual behavior by the entrants).
- o Summon immediate emergency assistance, if needed.
- o Warn unauthorized persons not to enter--or to exit immediately if they have already entered--and advise the authorized entrants, and management, of entry by unauthorized persons.
- o Assemble and inspect the equipment that the rescue worker(s) would need to enter the space.

- o Keep objects away from the access hole where they can be accidentally knocked, pushed, or dragged into the confined space. Lower tools or supplies to workers inside by a hand line.
- o When the job is finished and all objects have been removed from the confined space, replace the access cover.
- o Secure the safety line of any safety harnesses to a well-anchored object like an extraction tripod -- never to movable equipment or a vehicle. Monitor the safety line at all times, taking up extra slack as needed. Keep the safety line away from traffic and moving parts of any equipment.
- o Test the means of non-entry retrieval. You must use a mechanical hoist, unless manual methods would be more effective.

Although low - hazard entries do not require an attendant, every employee in the space must have a "buddy," who knows where they are and whether they are well. That buddy may enter the spaces or perform work that does not reduce their awareness of the employees in the space. The degree of vigilance with which the "buddy" must observe the exposed employee(s) is a permit condition that the space entry coordinator must review. Work teams larger than one person can provide "buddy system" protection to each other, as long as someone is aware of how every member of the team is doing.

Confined Space Entrants must

- o Learn about the hazards of the space, and the materials in it, and how to recognize the signs and symptoms of exposure to any toxic materials in the space.
- o Read and understand the permit.
- o Remove all jewelry before entering spaces in which the jewelry can compromise their protective clothing, catch on objects, or cause a spark.
- o Leave cigarettes, lighters, and pagers outside the space.
- o Avoid hand-to-mouth contact during entry.
- o Inspect his/her own and each other's personal safety gear before and during the confined space entry.
- o Wear or carry appropriate gas detector(s) during the entry.
- o Comply with these procedures and all of the conditions of the permit.

- o Follow the directions of the entry supervisor and the entry attendant.
- o Leave the confined space and report to the entry attendant immediately upon detecting; any non-permitted condition, an alarm, or the effects of a chemical exposure.
- o While working in a sub-surface space, avoid looking up.

Rescue Workers must

- X must remain immediately available through out the entry.
- X may perform other tasks during an entry **only** if those tasks do not impede response to emergencies.

When they are properly trained and close enough to provide quick response, request emergency agencies (such as industrial fire brigades) to provide stand-by rescue personnel. CSE coordinators may approve use of community rescue services in place of an on-scene rescue service for low-hazard entries.

CONFINED SPACE ENTRY PERMITS

Written entry permits are required for any entry into, or work in, confined spaces. Work teams that plan to enter a confined space must complete an entry permit form (Attachment C, CDM Confined Space Entry Permit). The permit: characterizes possible material and energy inputs to the confined space, identifies the personnel, describes the task, describes monitoring, lists required equipment, and identifies emergency contacts. Entry permits may only be issued by the CSE Coordinator. Call your operating unit's H&S manager if your local coordinator is not available. Actual entry is authorized only when the entry supervisor completes the pre-entry check list on the entry permit and signs the form at the bottom.

Most entry permits address a single work project in a single confined space, under specific conditions, for one work period not to exceed 8 hours. CSE coordinators can issue permits for tasks involving a group of spaces with common hazard potential (for example, an infiltration or inflow study on several manholes in a single branch line). CSE Coordinators may approve permits for longer periods if the personnel, tasks, and hazards are not expected to change. In either case, the Entry Supervisor still signs a copy of the permit prior to each entry (unless the coordinator authorizes another frequency).

Employees should note that the permit consists, mostly, of a shopping list on which they show the items they will use by marking AY@ in the boxes that represent the answers they choose. Answers you don't chose should be left blank. Where the form provides

a choice (e.g. glasses or goggles) the employee should circle the one chosen. The special instructions space on the permit is used for describing; lock - out arrangements, coordination with client or contractor personnel, or the qualifications of the emergency rescue personnel.

Employees who will enter a space which is 1) now free of hazards and 2) in which the hazards cannot change because the sources of material or energy are shut off and locked out, can meet the requirements of CDM's Confined Space Entry Procedure through completing a Low - Hazard Entry Permit (attached) and submitting it to the space entry coordinator for their operating unit. If sources of material or energy must be shut off, the form must show who will apply the controls and describe the lock - out procedures that will apply. Entry may proceed as soon as the space coordinator approves the permit (which can occur, for these low - hazard entries, by phone) and the required controls are in place.

When an entry occurs on a hazardous waste site the permit supplements, not supplants, the health and safety plan. If a team must conduct formal decontamination or monitor for a particularly complex set of air contaminants, the appropriate page from the hazardous waste health and safety plan should be completed and attached.

The permit forms are available as WordPerfect7 templates that many find saves time over manual completion. The computer mapping software available in many CDM offices reduces the effort in producing the hospital route map.

The CSE Coordinator must be informed of plans to perform hot work (burning, welding, or cutting) or to introduce chemicals to the space, such as cleaning solutions. The CSE Coordinator determines safety requirements based on the information he or she receives, therefore, providing complete and accurate information is essential to ensuring a complete permit and a safe entry.

When the entry is complete, the entry supervisor shall write "Canceled" across the permit and send it to the coordinator who issued it. The coordinator shall store one copy of the permit as an employee exposure record, and send another to the health and safety manager for his or her operating unit.

EQUIPMENT REQUIRED FOR CONFINED SPACE ENTRY

CDM personnel are approved to enter a confined space only with the equipment specified in the entry permit. The safety equipment listed in table 2, below, would be adequate for most foreseeable conditions.

TABLE 2 CSE EQUIPMENT REQUIREMENTS

Personal Protective Equipment:

Airline breathing mask or SCBA	Respiratory Protection
Work-space lighting	Self-contained breathing unit
Respiratory Protection	Forced ventilation blower
Steel-toe safety shoes	Hard hat
Surgical PVC inner gloves	Neoprene outer gloves
Chemical safety goggles	Rubber overboots or hip waders
PVC rain suit	Duct tape on wrist & ankle seams

Rescue Equipment:

Parachute-type safety harness	Safety lifeline
Automatic rescue winch	Rescue and retrieval tripod or derrick
First-aid kit	Two-way radios
Fire extinguishers	Mountain-climbing type ropes
Five-minute escape packs	Monitoring equipment as listed on the permit

Entry into many confined spaces with less equipment than that shown above may occur with the CSE coordinator's approval. Routine entries may be performed, for example, in regular work clothes when the coordinator has enough information about the conditions to approve their use.

Some circumstances that could change equipment needs include the following:

- o When the monitoring equipment reveals no contaminants in the air and if there is no potential source of contaminants or oxygen depletion, respiratory protection is unnecessary.
- o When the air and surfaces in the space are free of contaminants (not the case in sanitary sewers), protective clothing may not be needed.

- o When air contaminants in the space can affect the worker by adsorption through the skin, a level "A" suit may be required. CDM teams will not normally perform Level A work.
- o An SCBA (self-contained breathing apparatus), in stand-by working order, ready for use in emergencies may be required.
- o Another type of retrieval device may substitute for the tripod and winch assembly.

Only explosion-safe equipment may be used in confined spaces that pose a potential flammability hazard. Temporary lighting in these spaces--whether electrically or battery operated--must be low-voltage, double-insulated, and explosion-safe. Tools used in confined spaces will be of a non-sparking type unless there is no potential for flammable vapors or gases in the space.

PREPARATION FOR ENTRY

Inspect the area near the confined space for tripping hazards, traffic patterns, and ignition sources--like lit cigarettes. Provide controls or remove the hazards. If needed, use high visibility cones and fencing, post signs and assign a team member to control the area. If working in a public roadway, physically protect the entry with a vehicle. Isolate the space as described in Section F.

Inspect the condition of the entry steps of the confined space. Don't rely on manhole rungs or permanent ladders if the space is often wet. If it appears that the steps will not support your weight or if the confined space contains no steps, then provide a ladder and approved hoist--or some other form of ready entry, exit, and fall protection. Only one person at a time may ascend or descend a ladder. Personnel should not carry tools or other objects in their hands while climbing into or out of the confined space. Raise and lower supplies with a rope.

Potential emergencies vary with the type of confined space. The rescue equipment, including extraction device and SCBA, should be inspected and tested prior to space entry. Attachment D presents an SCBA check-out procedure.

Co-workers shall inspect each other's safety equipment before entry into the confined space to determine if it is properly adjusted and in the proper position. Co-workers shall periodically check the integrity of each others protective clothing and equipment. Problems, such as a tear in the clothing, shall be immediately addressed.

MONITORING

Combination combustible gas indicators **will be used** to test the air in the confined space for the presence of combustible gases and adequate oxygen levels before entering, unless the CSE Coordinator determines that air monitoring is unnecessary. The permit must specify tests for additional dangerous contaminants--such as hydrogen sulfide--that could be present in the confined space.

Prior to entry, the Entry Supervisor **must** test the atmosphere within the confined space by the procedures described below.

- o Start up, check voltage, and field-check the meters. Do this on site in a clean area, not near or in the confined space.
- o Insert the probe about 12 inches into the space. If possible, check for gas in the space without opening the manhole cover or hatch. Read the meters.
- o Drop the probe to the level that workers in the space will occupy; read it again.
- o To the extent possible, measure gas conditions in pockets, corners, and so forth.
- o Always check the low areas in the space since some gases are heavier than air (Hydrogen sulfide is heavier, methane lighter).

The air monitors must be field-checked in accordance with the instructions contained in the instrument manual. If the detector fails the prescribed field tests, it must be re-calibrated by the procedures established by the manufacturer. **No entry is permitted unless the required measurements have been collected.**

Because gases and vapors tend to vary in concentration in a confined space, the entrant closest to the suspected source must wear or carry the meter throughout the duration of the entry.

If any of these conditions pertain, the team must provide forced ventilation to eliminate the condition.

- A toxic material is present above half of its permissible exposure limit,
- Flammable gas is present above 10 percent of the lower explosive limit (LEL),
- Oxygen is below 19.5 or above 22 percent.

If any of these conditions pertain, entry into a confined space for any type of work is prohibited.

- Tests indicate the concentration of the flammable gases in the atmosphere is greater than 20% of the LEL,
- Oxygen is less than 19.5% or greater than 23.5%,
- A toxic contaminant is present in the air at or greater than it's IDLH.

The confined space shall be monitored as often as necessary to ensure the safety of employees, and whenever conditions change, such as temporary stoppage of mechanical ventilation or an increase in ambient air temperature. The required frequency of testing shall be a decision of the entry supervisor, based on the ongoing evaluation of the degree of hazard and recommendations from the CSE Coordinator. Unless the permit establishes another frequency, monitor air contaminants at least once an hour. Continuous monitoring provides the best protection.

ISOLATION

If material or energy can enter the space during entry, take necessary precautions, such as preventing accidental introduction of materials into the confined space and locking or tagging out energy sources.

Before employee(s) enter a confined space, the space shall be isolated to preclude the entry of materials and energy by one or more of the following methods:

1. Remove a valve or connection in the piping and cap the open end of the piping leading to the confined space. Do this as close to the space as possible.
2. Install a full-pressure blank in lines with flanged connections as close to the space as possible.
3. Close, lock and tag at least two valves in the piping leading to the confined space. Lock or tag **open** a drain valve to the atmosphere and check it to ensure it is not plugged.
4. De-energize, lock, and tag machinery, pumps, mixers, or other equipment with moving parts or conductors in the confined space.
5. Lock the gates to any dump-chute or loading port that connects with the space, or station a person at the port throughout the duration of the entry.

All employees working in the confined space shall be informed of the means by which the space was isolated. All blanks or caps shall be made of a material compatible with the liquid, vapor, or gas with which it may contact. If potential entry of materials or

energy represents the only reason to consider a space permit - required, the coordinator may waive the need for a permit after the space is completely isolated.

Sometimes CDM employees will enter a space through which flow can not be stopped (e.g. some municipal sewers). In these cases, the procedures documented in the permit must provide equivalent protection.

VENTILATION

When monitoring indicates a need for ventilation, provide an air inflow until acceptable air levels are achieved. Provide local exhaust or continuous general ventilation when the work itself (for example, welding or painting with solvent-based paint) generates a toxic atmosphere. Blowers should be coupled with large-diameter flexible hose that can direct air into the work area.

The blowers used must meet both the explosion-safety and wiring requirements of the National Electrical Code. They shall provide enough air flow to keep contaminant concentrations below 10% of the lower explosive limit and below OSHA's permissible exposure levels.

Gasoline, diesel, or gas-operated equipment used near confined spaces must be oriented so that their exhaust cannot enter the confined space. Exhausted air from the space must be directed away from the work area to an area where it presents no hazard.

Ventilation shall continue until acceptable air levels are achieved. Continuing ventilation may be required during entry. All ventilation equipment shall be located upwind to ensure fresh air intake and to ensure that contaminated air does not reach the blower, a potential source of ignition.

RESCUE PROCEDURES

Upon detecting an emergency condition, personnel in the confined space must adhere to the following procedures:

- o Immediately inform the attendant of the nature of the hazard.
- o Exit the space. Assist incapacitated coworkers toward the exit.
- o Take no action for which you are not properly trained and equipped. Do not move coworkers who have suffered or potentially suffered spinal injury and if in no other danger from the confined space. Only doctors and paramedics may treat spinal injuries.

Upon detecting an emergency, the entry attendant must:

- o Notify the rescue worker(s).
- o Remain outside the confined space to lower necessary rescue equipment into the space and render other necessary assistance.
- o Withdraw the worker(s) with the safety line.
- o Notify the emergency-service providers specified in the permit. Give the location of the emergency and any other pertinent information and guide emergency units to the scene.

Upon detecting an emergency, rescue workers must

- o Report to the confined space as quickly as possible.
- o If appropriate, don an SCBA.
- o Enter, if safe, to offer assistance and to correct the problem.

Protection of employee life and health is the first priority of the rescue worker. No employee may enter the confined space without an SCBA until all causes of the incapacitation have been eliminated. Rescue workers require protective clothing as resistant as that of the entrants unless otherwise specified in the permit.

The rescue team must be trained in

- o The requirements for entrants.
- o Rescue functions using the retrieval and rescue equipment used. NOTE: Rescuers must rehearse these rescue techniques at least once per year.
- o Basic first-aid and cardiopulmonary resuscitation. NOTE: At least one rescuer must possess a valid first-aid and CPR certification, the entry may not proceed.

REFERENCES

- A. OSHA Standard 29 CFR 1910.146, Permit-Required Confined Spaces, January 14, 1993

ATTACHMENTS

Attachment A - CDM Confined Space Entry Training Course Example

Attachment B - CDM Confined Space Entry Permit

Attachment C - MSA 401 Ultralite II SCBA Check-Out Procedure

Attachment D - CDM Confined Space Entry Coordinators

Attachment E - CDM Low - Hazard Space Entry Permit

CDM CONFINED SPACE ENTRY TRAINING COURSE EXAMPLE

Time	Topic	Format
8:00 - 8:20	Introductions	
8:20 - 8:45	Basic Confined Space Issues (Locations, Hazards, Permits, Un-permitted Entry)	Video
8:45 - 9:30	CDM Confined Space Procedure	Lecture
9:30 - 9:40	Break	
9:40 - 10:05	CDM Hazard Communication	Video
10:05 - 10:30	Subcontractors and Confined Spaces	Lecture
10:30 - 10:50	Personal Protective Equipment (Protective Clothing, Respirators)	Demonstration
10:50 - 11:00	Break	
11:00 - 11:20	Use and Maintenance of the Ultratwin APR	Video
11:20 - 11:40	Air - Purifying Respirators Workshop	Exercise
11:40 - 12:00	Traffic safety	Video
12:00 - 12:30	Lunch	
12:30 - 12:40	Principles of Lockout and Tag-out	Video
12:40 - 1:00	Exposure Monitoring Workshop (Toxics, Flammables, H ₂ S, Oxygen, Odor, Illness)	Demonstration
1:00 - 1:10	Response to Emergency Conditions	Video
1:10 - 1:40	Emergency Preparedness & Response	Lecture
1:40 - 1:50	Break	
1:50 - 2:15	Emergency Rescue Workshop	Discussion
2:15 - 2:30	Confined Space Ventilation	Video
2:30 - 2:55	Permit Procedure Workshop	Exercise
2:55 - 3:05	Harnesses, Tripods and Winches	Exercise
3:05 - 3:25	Shipping of Hazardous Materials	Video

CDM Confined Space Entry Permit

Project or Contract: Caltrans SR-73, 1085L Monitoring_____

Space to be Entered: 1085L GSRD 600 mm influent pipe and effluent manhole structure_____

Section drawing showing material and energy inputs attached? YES or X NO

Nature of Task: Entry to install and maintain water quality monitoring equipment_____

Hot Work? No_____

Is there a potential for:

Physical Injury? Yes_____ Vehicular Traffic? No_____ Toxic Gases or Vapors? Yes_____

Explosive Gases? No_____ Oxygen Deficiency? Yes_____ Exposure to Microbes? Yes_____

Heat Stress? No_____ Cold Stress? Yes_____ Engulfment? Yes_____

Duration of Permit: From: 02/01/2003 To: 06/30/2003_____

Entry Supervisor Stephen Liao, Wilfred Hsu_____

Authorized Entrants: Stephen Liao, Wilfred Hsu_____

Rescuers: Fire Department_____

Attendants: Stephen Liao, Wilfred Hsu_____

Means of Communication with Entrants:Vocal_____

Safety Equipment Outside the Space:

Needed? In Place? (To Be Initialed By Entry Supervisor)

No_____ Traffic cones or barriers in place

No_____ Ventilation system in operation

Yes_____ Rescue and retrieval equipment in place.

No_____ SCBA inspected and ready (topside) for emergency use.

N/A_____ Valves locked out or made inoperable (N/A if not applicable).

N/A_____ Electrical equipment disconnected & locked out (or N/A).

N/A_____ Pneumatic & hydraulic equipment disconnected & locked out (or N/A).

YES_____ Rescue service is currently available.

YES_____ Radio, phone, or portable phone reaches rescue team

N/A_____ Ignition sources eliminated/isolated.

Safety Equipment in the Space :

Needed? In Place?

No_____ SCBA or Airline respirator

No_____ Air filtering respirator

Yes_____ Steel-toe safety shoes

Yes_____ Surgical inner gloves

Yes_____ Leather or cloth gloves

Yes_____ Tyvek or Saranex coveralls

Yes_____ Safety goggles or glasses

Yes_____ Safety harness & lifeline

No_____ Fire extinguisher (topside)

Needed? In Place?

No_____ 5-min. escape pack

Yes_____ Ladder for entry

No_____ Rubber overboots

No_____ Rubber outer gloves

No_____ Cloth coveralls

No_____ PVC rain suit

No_____ Face shield

Yes_____ Hard hat

Yes_____ Flashlight or lamp

CDM Confined Space Entry Permit**Atmospheric Testing and Conditioning:**

Calibrate instruments per manufacturer's instructions. Measure gases just inside the space and at locations workers will occupy.

Needed?	Readings
_____ Time of Day	_____
_____ Oxygen deficiency (>19.5% and <21.5%).	_____
_____ Flammable gases (Less than 10% LEL).	_____
_____ Toxics (<PEL). Specify: _____	_____
<u>Yes</u> _____ Initials of Attendant	_____

Emergency Service**Provider****Telephone Number**

CDM 24 hour Emergency	CDM CHSO	732-539-8128
Health and Safety Manager	Rick Kern	909-762-0752
Project Manager	Shaun Stone	909-762-0750
Space Entry Coordinator	Stephen Liao	909-762-0755
Client Contact	David Aldrete	916-278-8104/916-328-5313
Fire Department		911
Police Department		911
Health Department		
Poison Control Center		
Hospital address		See HSP
Contact at hospital		
24-hour ambulance		
Route to Hospital (instructions or map):	See HSP	

Special Instructions: _____

PERMIT APPROVED: _____

 Confined-Space-Entry Coordinator Date

ENTRY APPROVED: _____

 Entry Supervisor Date

MSA 401--ULTRALITE II SCBA CHECK-OUT PROCEDURE

Monthly Inspection:

1. Check the cylinder label for a current hydrostatic test date.
2. Inspect the cylinder for large dents or gouges.
3. Inspect the cylinder gauge for damage.
4. Complete a routine inspection.
5. Fill out the appropriate records with results and recommendations.

Routine Inspection: Perform immediately before donning and after cleaning.

1. Before proceeding, check that the
 - o O-ring is present on the conical high-pressure fitting.
Bypass valve is closed.
Mainline valve is closed.
Regulator outlet is not covered or obstructed.
2. Backpack and harness assembly:
Visually inspect straps for wear, damage, and completeness.
Check the wear and function of the belt.
Check the back-plate and the cylinder holder for damage.
Check that the cylinder is firmly attached to the back-plate.
3. Cylinder and high pressure hose assembly:
Attach the high-pressure hose connector to the cylinder fitting.
 - o Check that the belt and the high-pressure hose are not tangled.
Open the cylinder valve and listen or feel for any leakage around the packing and the hose connection.
Check the high pressure hose for damage or leaks.
4. Regulator Function:
Cover the regulator outlet with the palm of your hand.
Open the round golden mainline valve.
Note the stoppage of air flow after the positive pressure has built up.
Compare the pressure reading on the cylinder and regulator gauges; they should be the same.
Close the mainline valve.
Remove hand from the regulator outlet.
Open the magenta bypass valve slowly. Note its function.
Close the bypass valve.

MSA 401--ULTRALITE II SCBA CHECK-OUT PROCEDURE

5. Warning Alarm and Regulator Integrity:
 - Cover the regulator outlet again with the heel of your hand.
 - Open the mainline valve.
 - While covering the regulator outlet, close the cylinder valve.
 - Move your hand from the outlet so the air drains out slowly.
 - Observe the regulator gauge reading at which the low-pressure alarm sounds. It should start sounding at 550 to 650 pounds per square inch (psi).
 - Remove your hand from the regulator outlet.
 - Close the mainline valve.
 - Blow air into the regulator for 5 to 10 seconds.
 - o Draw air from the outlet for 5 to 10 seconds.
 - X If a positive pressure or vacuum cannot be maintained, there is a leak. **DO NOT USE THE SCBA!**
6. Face piece and corrugated breathing hose:
 - Inspect the head harness and the Face piece for damage, serrations, and deteriorated rubber.
 - Inspect the lens for damage and proper seal in the Face piece. Inspect the exhalation valve for damage and dirt build-up.
 - With the breathing hose separated from the Face piece, inspect the hose connector for damage and presence of a wagon-wheel washer.
 - Stretch the breathing hose, and carefully inspect it for holes and deterioration.
 - o Attach the breathing hose to the Face piece.
 - Perform a negative-pressure test with the Face piece donned.
7. Storage:
 - Refill the cylinder to 2,216 psi.
 - Close the cylinder valve.
 - Tightly connect the high-pressure hose to the cylinder.
 - Bleed the pressure from the high-pressure hose by opening mainline valve.
 - Close the mainline valve.
 - Close the bypass valve.
 - Fully extend all of the straps.
 - Store the Face piece in a clean plastic bag for protection.

CONFINED SPACE ENTRY COORDINATORS

As of April 28, 1998, the persons listed below were authorized to approve permits for confined space entries by CDM employees. These coordinators are listed with their home offices to facilitate contact.

-Monica Beckman	CDM – Gig Harbor, WA
-Pat Dentler	CDM - Albuquerque, NM
-Tim Grant	CDM - Raleigh, NC
-Steve Hoffman	CDM - Orlando, FL
-Michael Leroux	CDM - Cambridge, MA
-Chris Marlowe	CDM - Edison, NJ
-Mark Mihm	CDM - Dallas, TX
-Chuck Myers	FPC - Fairfax, VA
-Steve Robinson	E&C – Syracuse, NY
-Robert Saiz	E&C – Denver CO
-Rick Shelton	CDM - Sarasota, FL
-Jim Skrabak	CDM - Cambridge, MA
-Ken Page	OOCh - Cambridge, MA

CDM LOW - HAZARD SPACE ENTRY PERMIT

Attachment E
Page 1

Project or Contract: _____

Space to be Entered: _____

Material and Energy Inventory (Section Diagram) Attached? YES or NO

Nature of Task: _____

Potential for:	Physical Injury?	_____	Vehicular Traffic?	_____
	Explosive Gases?	_____	Toxic Gases or Vapors?	_____
	Oxygen Deficiency?	_____	Exposure to Microbes?	_____
	Heat Stress?	_____	Cold Stress?	_____

Entry Supervisor _____

Authorized Entrants: _____

Rescuers: _____

Buddy: _____

Means of Communication with Entrants _____

Pre-Entry Check List:

Material (Flow) Sources to control	Procedure for Control and Lock - out	_____

Energy Sources to control	Procedure for Control and Lock - out	_____

Outside Safety Equipment

Needed? In Place? (To Be Initialed By Entry Supervisor)

_____	_____	Traffic cones or barriers in place
_____	_____	Entrants wearing safety harnesses.
<u>Yes</u>	_____	Rescue service is currently available.

Personal Protective Equipment for Entrants:

Needed?	In Place?		Needed?	In Place?	
_____	_____	Ventilation system	_____	_____	Steel-toe
_____	_____	safety shoes			
_____	_____	Rubber overboots	_____	_____	Surgical inner
_____	_____	gloves			
_____	_____	Rubber outer gloves	_____	_____	Leather or
_____	_____	cloth gloves			
_____	_____	Cloth coveralls	_____	_____	PVC rain suit
_____	_____	Safety goggles or glasses	_____	_____	Radio or
_____	_____	portable phone			
_____	_____	Hard hat	_____	_____	Work space
_____	_____	lighting			

Emergency Service**Provider****Telephone Number**

CDM 24 hour Emergency
Health and Safety Manager
Project Manager
Space Entry Coordinator
Client Contact
Fire Department
Police Department
Health Department
Poison Control Center
Hospital address
Contact at hospital
24-hour ambulance
Route to Hospital (instructions or map):

CDM CHSO

800 / 313 - 5593

Special Instructions:

PERMIT APPROVED:

Confined-Space-Entry Coordinator

Date

ENTRY APPROVED:

Entry Supervisor

Date

Attachment 5
Caltrans Maintenance Manual
Chapter 8 – Protection of Workers

CHAPTER 8

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8.00 Introduction

It is Caltrans policy to conduct its business in the safest possible manner consistent with applicable law, rule or policy.

This chapter of the Caltrans Maintenance Manual is a part of the Caltrans written injury and illness prevention program. It provides detailed instructions for Maintenance managers, supervisors and employees. It is designed to help employees in their efforts to work safely. All employees are expected to follow these minimum guidelines.

Other employee safety subjects are covered in the Maintenance Code of Safe Operating Practices, other chapters of this manual, and in the Departmental Safety Manual.

An important factor to be considered in employee safety is the false sense of security acquired when workers have not had a recent close call. It is also the hardest to protect ourselves, against. On rural routes, we may have only 100 vehicles pass per day. In a metropolitan District, we may have more than 333,000 vehicles pass each day within a few inches or feet of our work sites. In 1996, the California Highway Patrol arrested 91,988 motorists for Driving Under the Influence (DUI). In fact, eight of the last twelve highway workers killed on the job were struck by motorists that were DUI.

The most important part of our job is to protect ourselves from traffic, while getting our work done. We do this by:

- (A) Letting the motorist know what's going on and where to drive.

For this we use signs, flags, barricades, cones, flashing amber lights, changeable message signs (CMS) and flashing arrow signs (FAS).

- (B) Avoiding the errant driver.

Face traffic, stay aware through your own eyes and ears or those of a lookout who will warn you. Plan your escape route.

- (C) Using protective equipment.

Protective vehicles, truck mounted crash cushion headrests and seat belts/shoulder harnesses.

- (D) Planning the work to reduce employee exposure to traffic.

8.01 Managers and Supervisors Responsibilities

The following paragraphs summarize the basic elements of the Caltrans injury and illness and prevention program and define who is responsible for enforcing the safety and health policies and practices. For further information consult Chapter 1, the Caltrans Injury and Illness Prevention Program, in the Departmental Safety Manual.

- (A) Supervisors and managers are the responsible persons to implement, maintain, and enforce Departmental safety rules and policies.
- (B) Supervisors, in cooperation with training personnel, shall develop safety related training programs to ensure all employees receive:
 - (1) General training to cover hazards basic to all places of employment.
 - (2) Specific training to cover hazards that are unique to each employees' job assignment.
- (C) Supervisors shall ensure that each employee is able to understand how to complete each assigned task safely.
- (D) Supervisors shall ensure that each employee follows safe and healthy work practices and procedures.
- (E) Supervisors shall keep abreast of safety and health regulations affecting the operations they supervise.
- (F) Supervisors shall advise management of safety training needs of subordinates.
- (G) Supervisors shall ensure that each employee is provided with the equipment, necessary to complete assigned tasks safely.

8.02 Work Site Safety

Caltrans commits to promoting an effective injury and illness prevention program. Managers and supervisors are responsible to:

- (A) Routinely inspect all field and facility work areas under their jurisdiction to identify, document, and eliminate physical or environmental hazards that may contribute to injuries or illnesses. In order to accomplish this, Region Managers should do three or more safety reviews per month and Area Superintendents should do three or more field or facility safety reviews per week.

- (B) Routinely review, study, and document all operating methods, practices, and procedures to reduce or eliminate the potential for injury or illness.
- (C) Counsel, train, and discipline employees when appropriate to reduce human factors that contribute to injuries or illnesses.
- (D) Investigate every injury or illness and vehicle accident to:
 - (1) Determine contributing circumstances, and
 - (2) Develop information that leads to correcting unsafe conditions and unsafe acts.
- (E) Establish and maintain codes of safe operating practices, or equivalent, which identify hazards specific to job assignments.
- (F) Enforce all rules, laws, and policies that will promote, protect, and preserve employee safety and health.

8.03 Individual Responsibilities

All employees shall do everything reasonably necessary to protect their own safety and health and that of others, by complying with all occupational safety and health policies, procedures, laws, rules, or regulations. They shall report all injuries, illnesses, or unsafe conditions to their supervisor at once, or before the end of the work shift.

All employees are expected to report to work mentally and physically capable of performing all of their assigned duties without jeopardizing the safety and health of themselves, other employees, or the public. They shall be free from the effects of medication, controlled substances, alcohol, or the complications arising from illness or injury, which might impair their judgment and/or ability to perform their work.

Employees are responsible to notify their supervisor of any personal medical condition or prescribed medication, which might impair their ability to perform their assigned duties. Employees should also report to their supervisor any behavior by an employee, which reasonably indicates that they are not fit for duty.

Supervisors or managers who observe an employee that appears to be unable to perform his/her assigned duties and have a concern about the safety of the employee or others, are responsible to prohibit that employee from continuing to work. The employee should be prohibited from working until a determination of the reason for the employee's behavior is made, or until a medical evaluation of the employee's fitness can be completed.

Any employee who violates any safety and health policy, procedure, regulation, law, or rule may be disciplined in accordance with the provisions described in the Caltrans Guide to Employee Conduct and Discipline.

Any supervisor or manager who fails to enforce safety and health policies, procedures, regulations, laws, or rules shall be disciplined in accordance with the provisions described in the Caltrans Guide to Employee Conduct and Discipline.

Supervisors and managers shall ensure that employee safety and health issues are discussed and assessed with employees at least annually at the time of issuing an Individual Development Plan/Performance and Appraisal Summary, and/or at the time supervisors discuss employee probationary reports.

Supervisors in office work settings should include discussions about health and safety matters at routinely scheduled staff meetings, but, at a minimum, shall have meetings with their employees at least quarterly to discuss safety and health issues.

Supervisors in field locations shall have tailgate safety meetings, at least every 10 working days in compliance with the requirements of the Construction Safety Orders, §1509(e).

Supervisors shall also conduct meetings with employees when they are first hired, or when a new process, chemical, or procedure is introduced that contains a new or previously unrecognized hazard or when a new or previously unrecognized hazard is identified.

8.04 Responsible Person In Charge

It is practice and policy that whenever two or more employees are assigned to work together, one of the employees shall be placed in charge.

This responsibility is usually assigned to the designated supervisor or lead-worker based upon his/her civil service classification. However, there may be occasions when these individuals are unavailable to direct the work for given periods of time, or where emergencies arise that require non-supervisory employees to direct the work of others.

Supervisors must always designate an individual to be in charge during any planned absence, and identify the steps to be taken in the event of an emergency.

8.05 Changing Chapter Standards

Chapter 8 requirements are intended for the usual situations. Unusual circumstances may call for greater or lesser protective measures than are described here as standard. It is not possible, or even desirable, that a manual such as this contain detailed rules for every possible situation. It is up to the supervisor to exercise judgment in applying these measures. Supervisors should not, through the use of protective devices, create greater hazard to their crews by increasing the severity and/or duration of exposure.

Deviations from standard measures may be judged desirable by the supervisor for a variety of reasons such as sight distance, proximity of ramps or street intersection, restrictive width, short duration of job at one location, or minimal exposure because of volume, speed, and proximity of traffic. Decisions to reduce standard measures must have the written approval of someone responsible for the work at the Area Superintendent level or higher. This authority may be delegated to the Supervisor at the Districts discretion. This written approval shall describe the deviation and list the reasons it is needed. It shall be kept on file in the regional office for three years. This written approval is not needed in situations, which develop suddenly and unexpectedly and demand immediate action to prevent injury or harm to workers or the traveling public. Operations should be brought up to standard as soon as resources become available. The supervisor may increase worker protection using standard devices without approval.

The standard lane closure plans, Standard Plan T10 through T17, are for normal work zones and conditions. In unusual situations, the Maintenance Engineer may request the District Traffic Engineer to authorize a deviation at a specific location, providing:

- (A) The specific location is identified by County, Route and Post mile.
- (B) The deviation does not compromise the safety of workers.
- (C) The deviation is not for general use throughout the District.
- (D) The deviation and rationale are documented in District files.

The intent is to allow deviation at specific locations without creating individual District wide standard plans. A deviation could be allowed for an indefinite time at a specific location, if the special conditions remain unchanged.

8.06 Personal Protective Equipment

Caltrans provides the personal protective equipment (PPE) employees will need to work safely. This equipment is for worker protection and they shall use it properly to prevent injuries.

Personal protective equipment consists of many items. Hard hats, orange shirts, safety vests, safety glasses, earplugs or muffs, gloves, goggles, respirators, rain gear, and foot protectors are some examples.

The supervisor should select and provide the proper equipment and ensure workers wear it.

Refer to Appendix C of the Code of Safe Operating Practices and Chapter 12 of the Departmental Safety Manual for more information about personal protective equipment. Refer to Chapter 15 of the Departmental Safety Manual for a guide to using respiratory protection.

8.07 Emergency First Aid

All maintenance employees should be trained in Standard First Aid during the first three months of their assignment, and at least once every 3 years thereafter. All Tree Maintenance Workers and related classifications and all Electrical Workers and related classifications shall be trained in Cardio Pulmonary Resuscitation (CPR) during the first month of their assignment and then at least once a year thereafter. The training must be certified by the American Red Cross or other accredited organization.

An approved first aid kit must be available at each work site. First aid kits and supplies shall be kept in sanitary and usable condition and inspected at least monthly. The Departmental Safety Manual, Section 9.09 and 9.10, specifies size, location, and quantity of supplies for various categories of first aid kits.

For more information on first aid and emergency medical care see Chapter 9 of the Departmental Safety Manual.

8.08 Medical Treatment

Supervisors are responsible to ensure that if an injured or ill employee needs medical attention he/she will be taken to the nearest approved medical clinic, or hospital emergency room for treatment. Supervisors shall post the name and location of each approved medical service provider in a conspicuous place at each Caltrans work site. At a minimum, they shall be posted on designated bulletin boards in hallways or individual offices, and other appropriate locations, such as motor vehicles, that will ensure every employee is aware of the locations.

If the injury is serious an ambulance should be called.

A supervisor or designee shall always accompany the injured or ill employee to the medical facility.

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As conditions warrant, the supervisor should talk with the attending physician to determine the extent of the injuries, the affected employee's recovery period and ability to return to work, and the employees ability to perform the full range of duties upon release.

The supervisor must describe to the doctor what modified duty is available so that the employee can return to work as soon as possible.

Employees shall report any work-related injury to their supervisor, immediately, or at least before the end of the work shift. They shall also report the injury to the supervisor before going to a doctor.

For more information on personal injury accidents and illnesses see Chapter 9 of the Departmental Safety Manual

8.09 Transportation of Workers

Workers shall be transported in vehicles equipped with seats and seat belts. Workers shall not be allowed to ride in the beds of dump trucks, buckets of loaders, or any other place on a vehicle that was not designed for driving or riding.

8.10 Relation of Chapter 8 to Chapter 7

Chapter 7 of this manual contains the separately published booklet, Manual of Traffic Controls (MTC), 1996 (Revision 1). The MTC is produced by the Traffic Operations Program. In case of any inconsistency between the MTC and Chapter 8 of the Maintenance Manual, Maintenance forces are to follow Chapter 8.

8.11 Definitions

Arrowboard	Refer to "Flashing Arrow Sign" or "FAS". The terms "arrowboard" and "flashing arrow sign" are synonymous.
Flashing Amber Light	This term includes such devices as flashing lights and rotating beacons.

Flashing Arrow Sign (FAS)	The Type I is an 8 feet x 4 feet (2400 mm x 1200 mm), trailer mounted FAS. The Type II is a 6' x 3' (1800 mm x 900 mm), vehicle mounted FAS. FASs have several modes. The caution mode has four lights flashing and the arrow modes flash right or left. See Section 8.21, The Use of the Flashing Arrow Sign.
Moving Operations	A moving operation is any work activity that moves along the traveled way slower than the prevailing speed of traffic. Some examples are striping, sweeping, etc.
Short Term Operation	A short-term operation is any work activity that can be performed in 10 minutes or less during light traffic volumes, without interfering with traffic or placing the employee in jeopardy. Some examples are pavement patching, removing a large piece of debris, etc.
Stationary Operation	A stationary operation is any work activity that includes workers on foot or equipment occupying any part of a paved shoulder or the traveled way at one location for more than 10 minutes. See exception noted in Section 8.28 (D) Moving Shoulder Operations.
Supervisor	The term supervisor as used here refers to any individual who has direction or control over another employee; however for approval of deviations, a supervisor is defined as one who is classified as a supervisor by his/her civil service classification.
Traveled Way	The traveled way describes that portion of the roadway where vehicles normally drive. This includes traffic lanes, turning lanes, and ramps. It does not include paved or unpaved shoulders or medians.
Truck Mounted Crash Cushion	The terms truck mounted attenuator (TMA) and truck mounted crash cushions (TMCC) are synonymous. The TMCC is designed to absorb kinetic energy. The TMCC softens the blow to our driver and usually reduces the impact to the motorist. While the TMCC on the truck reduces accident severity, it does not reduce the distance a vehicle will roll ahead when hit from behind.

There are three classes of protective vehicles: Shadow, Barrier, and Advance Warning. All shadow vehicles and barrier trucks shall display a standard pattern of orange and white diagonal reflective striping on the back of the vehicle and/or the truck mounted crash cushion.

(A) Shadow Vehicle

A shadow vehicle is used to protect the work vehicle in a moving operation. A shadow vehicle shall:

- (1) Have a truck mounted crash cushion (TMCC).
- (2) Carry a FAS operating in the arrow mode while occupying a lane on multilane roads.
- (3) On two lane roads, carry either a FAS operating in the caution mode or a flashing amber light.
- (4) Be equipped with headrests.
- (5) Be equipped with seat belt and shoulder harness.
- (6) Be equipped with a two-way radio.

The shadow vehicle headrest protects the drivers' head and neck. The seat belt and shoulder harness prevent the driver from being thrown forward. Normally, the shadow vehicle shall be occupied by the driver only. However if a passenger must occupy the vehicle while it is shadowing, the passenger seat shall also be equipped with headrests and a seat belt and shoulder harness.

The purpose of a shadow vehicle is to provide physical protection for crews and their vehicles. The mass of the vehicle is the most important factor in protecting the driver of the shadow vehicle, the crews and the vehicles. The heavier the shadow vehicle, the better the protection, that is provided. A shadow vehicle shall have a Gross Vehicle Weight (GVW) greater than 19,800 pounds (9000 kilograms).

The shadow vehicle shall be positioned upstream from the work vehicle between approaching traffic and the vehicle it is protecting. It should be positioned where it will provide the best protection; not too close, or not too far back. It must be close enough to intercept errant vehicles, but far enough back to not roll ahead into the work vehicle. The shadow vehicle should remain approximately three seconds behind the work vehicle.

Shadow Vehicle Spacing Using 3 Second Rule

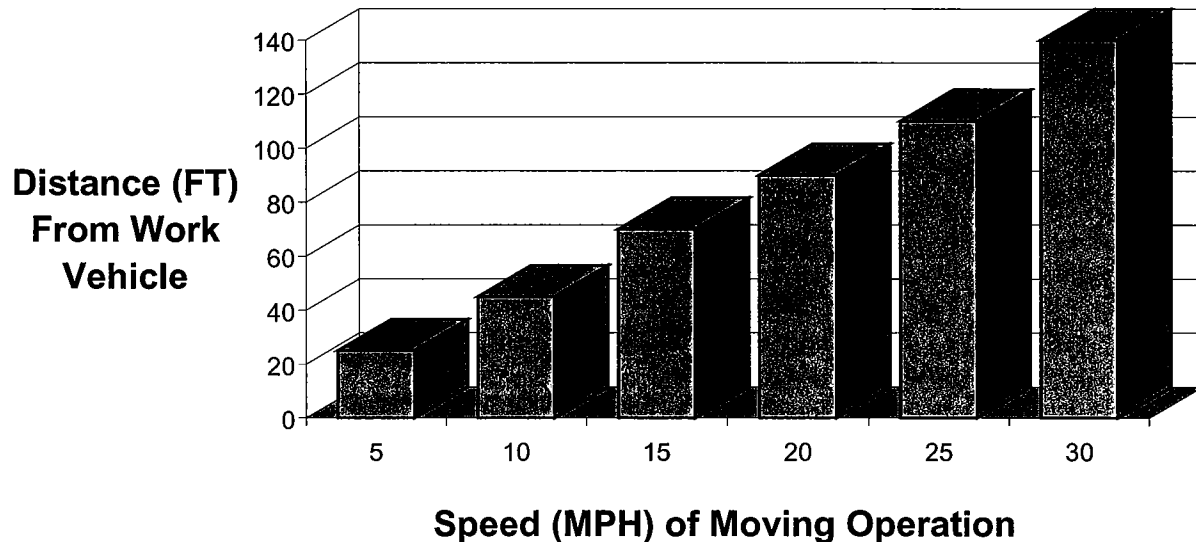


Figure 8-1: Shadow Vehicle Spacing

(B) Barrier Vehicle:

A barrier vehicle is an unoccupied vehicle or piece of equipment used to protect workers from errant motorists. Any vehicle at a work site can be used as a barrier because there is no minimum barrier vehicle size. However, workers shall use the heaviest vehicle reasonably available. In certain instances, more than one barrier vehicle may be needed. A barrier vehicle does not require a TMCC. However, if a TMCC is available, it should be used.

Any vehicle that is used should be parked upstream from the work site between approaching traffic and the workers. It should be parked where it will provide the best protection; not too close to the workers, not too far back. It shall be carefully positioned so that it will intercept errant vehicles, but will not roll ahead into the work area. Roll ahead may be controlled by proper brakes, sufficient space, angle parking and the transmission in gear or in park.

A barrier vehicle without a TMCC can be parked a number of ways. It can be parked at an angle or even straight across the lane. If it is parked at an angle, the front of the vehicle should be pointed away from traffic. The wheels shall be turned away from the work zone and away from traffic. This will avoid motorist panic and prevent secondary collisions if the barrier vehicle is hit and pushed ahead. A barrier vehicle with a TMCC should only be parked parallel with the direction of traffic.

(C) Advance Warning Vehicle:

An advance warning vehicle is driven or placed upstream from a work zone (refer to the Moving Lane Closure Plans T15, T16 or T17). It advises the approaching motorists of what conditions to expect ahead.

On the shoulder of a two-lane highway, it shall display either a FAS in the caution mode, or a flashing amber light/rotating light. On the shoulder of a multilane highway, a FAS with the "Flashing Arrow" displayed shall be used if the work vehicle is on the traveled way. A changeable message sign may be used instead, of a FAS.

If the vehicle encroaches into the traveled way, it shall be equipped as a shadow vehicle. If it encroaches into a freeway lane, the vehicle shall display a FAS in the arrow mode. If it encroaches into a two-way conventional highway, the FAS shall be in the caution mode or display a flashing or rotating amber light.

8.13 Planning Work To Reduce Worker Exposure

Managers and/or Supervisors shall plan work to minimize the amount of time employees are exposed to moving traffic. This can be done, by choosing proper work methods, combining operations, avoiding high traffic volume periods, and reducing the threat from non-attentive, speeding drivers.

Work methods and procedures should be designed to keep the amount of time workers are exposed to moving traffic to a minimum. For example, crews should be instructed to assemble in safe areas well away from the traveled way, convoy to the work site, and do their work expeditiously. Once work is completed, they should return immediately to a safe area.

In addition, when employees reach the work site, the work method should be designed to minimize the amount of time, workers spend on foot near moving traffic. The first choice should be to use mobile, power equipment to do the work. A worker in a piece of equipment is generally much safer than a worker on foot. The next choice of work methods would be to provide workers on foot with physical protection. For example, a barrier vehicle, guardrail, or some other obstacle can be used to provide physical protection. The last choice is to have workers on foot without physical protection.

In this situation, the work method should be designed so that workers can face traffic whenever possible and can work apart as individuals and not in groups, close together. If none of the above methods are possible, it may be necessary to have lookouts or a lookout alarm device or both. See Warning Systems - Lookouts, Section 8.16.

When a lane closure is planned, especially on freeways, managers and supervisors should contact all crews who could work within the closure. With more crews involved, more work can be accomplished. For example, along with roadway repair, stencil work, guardrail repair, electrical work, sign work, shoulder repair, sweeping, and landscaping can be completed. Not only will more work be completed, but more protective vehicles may be available at the work site, providing workers with increased protection. In addition to maintenance operations, managers should coordinate with District Traffic Operations, Surveys and other District units for work needs within the closed lane. This approach will reduce employee exposure to traffic. It will also reduce the number of lane closures required for routine maintenance.

When planning combined operations, managers and supervisors shall also plan the work so that each employee has enough space to work safely. They shall consult Crowding of Workers, Section 8.17.

Another opportunity to reduce worker exposure to moving traffic is to carefully plan work on the highway. When there are fewer vehicles on the traveled way, there are fewer vehicles with an opportunity to hit workers. Managers and supervisors should consider reducing employee exposure by requiring an unconventional workweek or extended and/or multiple work shifts to take advantage of these lower traffic volumes. Managers should also review maintenance projects for opportunities to improve worker safety with a complete facility closure.

Before short-term tasks are assigned, the supervisor will determine if the task has to be done immediately, or if it could wait. He/she shall decide if it could wait until formal traffic control will be set up and the job performed as a part of a combined operation. An example would be the removal of litter from a center median area. If the debris is not a safety hazard, could picking it up wait until a lane closure is set for another reason?

Supervisors shall plan all work methods to minimize the need for the backing of equipment and vehicles at the work site.

8.14 Working Near Moving Traffic

When working on or near the traveled way for any amount of time, workers must be aware of the hazards from errant vehicles. If available, a vehicle, regardless of its size, shall be used as physical protection from traffic. Workers on foot shall face traffic whenever possible. If two or more persons are working close together, a lookout may be necessary (consult Warning Systems - Lookouts, Section 8.16).

Employees should work quickly, but safely, and return to their vehicle as soon as work is completed.

When working on the outside radius of curves, workers should be aware that some vehicles, may have the tendency to drift to the outside.

Traffic on two lane conventional highways is often lighter than on freeways. Workers cannot let this fact lull them into a false sense of security.

When working on conventional two lane roads, employees shall be aware that errant vehicles can come into the work area from either direction. Many two-lane operations involve short-term work such as fixing guide markers, straightening signs, and litter removal. These operations involve workers on foot, often next to the traveled way. When employees are working by themselves, they must make sure that they use their eyes and ears to look and listen for danger signals to ensure their personal safety.

It is recommended that employees who need to be highly visible during the day should wear white coveralls and the proper warning garments as described in the Departmental Safety Manual, Chapter 12, Section 12.20, to increase their contrast with orange equipment.

8.15 Facing Traffic (Employees on Foot)

The Supervisor shall plan and supervise the work to minimize the amount of time workers will have their backs to traffic.

Unless there is a clear reason for doing otherwise, employees shall continually face oncoming traffic while working on or near the traveled way. This is the personal responsibility of every worker.

Facing traffic is the most important thing workers can do to protect themselves and their coworkers while working on or near the traveled way. Facing traffic gives workers a better opportunity to see and hear errant vehicles. This allows them a chance to move out of the way and warn fellow workers.

8.16 Warning Systems-Lookouts

While working on foot on or near the traveled way, workers should normally be protected by barrier vehicles, guardrail, or other physical means. Where the absence of such physical protection exposes workers on foot to errant vehicles, a person shall be assigned as a lookout according to circumstances described below.

A lookout shall be assigned if all of these conditions exist:

- (A) Work occurs on a roadway with a posted speed limit of 55-mph (88 kph) or more.
- (B) Workers are without physical protection.
- (C) Two or more people working close to each other.
- (D) Working within 30 feet (9 meters) of moving traffic.
- (E) A person is on foot.

The lookout shall continually watch approaching traffic for errant vehicles that may hit workers on foot. If trouble is suspected, the lookout shall warn the workers by yelling, using a vehicle or warning horn, a portable lookout alarm device or any system capable of communicating the warning message. This warning is intended to give workers the time to use a planned escape route to avoid the errant vehicle.

A lookout shall not be assigned any other duties.

Lookouts shall be rotated often enough to keep them alert.

The supervisor may use a crew lookout whenever he or she thinks it is needed. Even if workers are physically protected, using a lookout may be beneficial.

Electrical and mechanical detection systems may be used to supplement the human lookout.

Slope watchers shall be used when working under unstable slopes where rocks may fall and injure workers. These slope watchers shall not be assigned to watch the slope and to lookout for traffic at the same time. Refer to the Maintenance Code of Safe Operating Practices, Slope and Embankment Maintenance, and Appendix D, Cut Slope Safety and the Departmental Safety Manual, Chapter 21, Cut Slope Safety.

8.17 Crowding of Workers

Supervisors shall plan work so that each employee has adequate space to work safely.

Supervisors shall ensure that employees know their responsibilities for positioning themselves so that each employee has enough work space to work safely and avoid being struck by flying material or another worker's tools.

Workers shall avoid unnecessary gatherings, which increase accident exposure and cause public

concern.

8.18 Access to Median Work Zones

- (A) Workers should not walk across traffic lanes to work in median areas. They shall drive into the median area and park when possible. However, the width and condition of the median must be considered. If the area is too narrow, wet, sandy or is difficult to accelerate from, it should be avoided.
- (B) If it is not possible to park in the median area and crossing on foot is necessary, the following rules must be followed:
 - (1) Workers shall not run. They shall wait for a break in traffic adequate to allow them to walk across the lanes.
 - (2) Workers shall not carry tools or items that would slow them down and make the crossing unsafe.
 - (3) If the traffic is too heavy and a traffic break is not available, workers shall wait for a safer time to do the job. If they must cross, they shall call for traffic control or ask for a CHP traffic break.

8.19 Picking Up Litter and Debris

Normally, the safest way to pick up litter is to work individually and always, face approaching traffic. Trucks should be parked away from the work area, unless needed to provide protection from traffic. The workers may be dropped off and picked up later. The practice of employees walking beside a truck loading litter with a pitchfork or other hand tool should be avoided.

In narrow medians protective vehicles may be necessary at both ends of the work area.

Litterbags should not be filled so full that they will be too hard to lift. The bags should be placed where workers can easily pick them up with minimum exposure to traffic. When possible, the bags should be stockpiled to reduce the number of stops needed for bag removal.

Hypodermic needles should not be placed in the bags. For more information, refer to the special instructions for the Disposal of Hypodermic Needles in the Maintenance Code of Safe Operating Practices. Other sharp objects, heavy metal objects, tire caps, or concrete chunks should not be placed in litterbags. These items could seriously injure the person who picks them up.

When retrieving debris from a freeway lane, workers shall wait for a break in traffic. A break in traffic is defined as all lanes clear of traffic long enough for the employee to walk out, retrieve the debris, and walk back to the shoulder. If no traffic breaks occur, the California Highway Patrol should be contacted to provide one.

Workers shall not try to flag traffic or use hand signals to create a traffic break.

When debris is retrieved from the traveled way, workers shall follow these guidelines:

- (A) Workers shall remain in the vehicle until the traffic break approaches.
- (B) An escape route shall be planned before leaving the vehicle. The vehicle shall not be parked where it will block the workers' escape route.
- (C) When workers are on foot, their vehicle shall be kept between themselves and approaching traffic. Workers shall walk on the outer edge of the shoulder, staying as far from moving traffic as possible.
- (D) Workers shall always face approaching traffic.

The above procedures, except the traffic break, should be followed when removing debris from shoulders.

8.20 Maintenance Crews Working Across From Each Other

Maintenance crews shall not work on opposite sides of a highway, directly across from each other.

Work sites on opposite sides of a conventional highway or on opposite sides of one roadway of a divided highway should be at least 2000 feet (600 meters) apart. However, if the traffic is positively controlled by flaggers, stop signs, or traffic signals, the work sites can be closer.

8.21 The Use of the Flashing Arrow Sign (FAS)

Arrow messages pointing left, right, or to both sides, are to be used as action messages. An arrow is to be used only when requiring the motorist to change lanes. An arrow message is not to be used when a vehicle is parked in a closed lane unless it is being used for the arrow closing that lane.

In the flashing arrow mode, all lamps forming the arrowhead and shaft shall flash on and off simultaneously. During hours of darkness the FAS shall be dimmed to prevent the haloing and blurring of the arrow image.

To alert the motorist to work activity near, but not on the traveled way, the caution mode of the FAS is to be used.

Any shadow vehicle working on the traveled way of a multilane highway outside of a lane closure must be run with a FAS board in an arrow mode.

Work vehicles that are being shadowed should usually not display a FAS. Two partially superimposed FASs may not give a clear message.

8.22 Flashing Amber Lights and Rotating Amber Lights

Amber lights shall be used to alert motorists to work activity near, but not on, the traveled way.

Flashing and/or rotating amber lights are to be used on motor graders, snow removal equipment and other specialized equipment that are operated on the traveled way at lower than prevailing traffic speeds.

Flashing amber/rotating lights are to be used on pilot cars not having a FAS.

Amber lights are not to be used while driving at prevailing speeds, when parked in an established lane closure, or when no danger to the employee or motorist exists. Warning lights, to be effective, must only be used when they are needed. A flashing amber light should not be used at the same time as a flashing arrow sign because the arrow becomes more difficult to read.

During the hours of darkness, amber lights should be used with discretion. At times, the vehicles emergency flashers may be more effective.

8.23 Signs

Advance warning signs shall be placed when a stationary operation is on the traveled way or is on the shoulder within 6 feet (1.8 meters) of a traffic lane on a multilane highway with a paved shoulder 8 feet (2.4 meters) or more in width. Also, warning signs shall be placed well in advance of the work, when traffic slows, changes lanes, or moves from its normal course of travel because of the work. The standard signs shown in the 1996 Caltrans Manual of Traffic Controls and in Standard Plans T10 through T17 shall be used.

Portable signs should be placed on sign standards with two or more orange flags. The sign standard shall be in an upright position with the center of the sign panel a minimum of 5 feet (1.5 meters) above the pavement. A cone shall be placed next to each warning sign. If portable signs are displaced or overturned, from any cause, during the progress of work, they shall be immediately replaced in their original locations.

A barrier vehicle or a shadow vehicle shall be used as protection from traffic while setting and retrieving warning signs. A shadow vehicle shall be used as a protective vehicle during the installation and retrieval of traffic cones and signs in the taper and tangent sections of a lane closure.

When work is temporarily stopped or finished and traffic is not affected, all signs shall be promptly removed, dropped down or turned away from traffic. Using signs that do not affect traffic will reduce their effectiveness. In addition, installing them when they are not needed will increase worker exposure to traffic.

Extra warning signs may be used, when appropriate. For example, if queues are expected to develop in lane closures with reversible control, extra 'Prepare to Stop' signs can be installed.

Placing an advance warning sign, such as a 'Road Work Ahead' sign, on the rear of a work vehicle is inadequate and is not permitted. However, an advance warning sign may be used on an advance warning vehicle.

Signs on vehicles with messages such as 'Warning - This Truck Makes Frequent Stops' are advisory only and do little to protect the workers. They should only be used on low speed roads or city streets. When this type of sign is used, an amber light or FAS in the caution mode shall be used along with it.

Signs, such as 'Loose Gravel', 'Fresh Oil', etc., may be placed on barricades. The barricades shall be ballasted by means of sandbags placed on the lower parts of the barricade frame or stays. The sandbags shall not be placed on top of the barricade nor, over any reflectorized barricade rail facing traffic.

8.24 Lane Closures

A lane closure shall be set if a stationary operation takes more than 2 feet (0.60 meters) or reduces the width to less than 10 feet (3 meters) of an existing lane on a multilane highway. To take up to 2 feet (0.60 meters) of a lane on a multilane highway without a lane closure, a cone taper shall be installed that begins at least 300 feet (90 meters) upstream from the work area. The taper shall have 28 inch (700 mm) cones spaced 50 feet (15 meters) apart.

The lane of a two-lane highway shall be closed if work reduces the width of a lane to less than 10 feet (3 meters). Traffic shall not be moved across the center stripe without a lane closure or other means of traffic control.

A space of 6 feet (1.8 meters) should be maintained, whenever possible, between moving traffic and the work area.

When closing a lane, a barrier vehicle or a shadow vehicle shall be used for the installation of the signs and the FAS if they can be placed while off the traveled way on the shoulder or median. A shadow vehicle or a barrier with a TMCC shall be used as the protective vehicle during the installation and retrieval of traffic cones and signs in the taper and tangent sections of the lane closure. All devices placed in areas with no shoulders from an open lane require the use of a shadow vehicle for protection.

Lane closures shall be placed according to the Standard Plan T10, Traffic Control System for Lane Closure on Freeways and Expressways or the Standard Plan T11, Traffic Control System for Lane Closure on Multilane Conventional Highways.

If a lane closure begins to cause traffic to back up (commonly called queuing), the advance warning signs shall be moved back in advance of queuing. If the signs cannot be moved back, the lane closure must be removed. If the lane closure results in a significant traffic delay, the closure may need to be removed.

A Changeable Message Sign (CMS) may also be used to redirect traffic and relieve queuing. The additional CMS may be used at key interchanges and exit ramps and other locations where traffic queues may be expected due to maintenance activities.

8.25 Placing the Flashing Arrow Sign (FAS)

The flashing arrow sign (FAS) should be placed on the shoulder at the beginning of the taper as shown in Standard Plan T10. If there is no shoulder, the FAS should be placed as close to the beginning of the taper as possible. A minimum 1500 feet (450 meters) of sight distance shall be provided where possible for vehicles approaching the first FAS.

If the FAS cannot be located properly, consider placing the taper in a different or safer location.

In multilane closures on freeways and expressways (Standard Plan T10), one FAS must be used for each lane closed. The first FAS used should be a Type 1 (4 x 8 feet) (1200 mm x 2400 mm). The second and succeeding FAS may be either a Type 1 or Type 2.

8.26 Closing Auxiliary Lanes

Work occurring at the beginning of an auxiliary lane such as a truck lane or lane added to increase capacity, will require as a minimum the shoulder closure plan shown on Standard Plan T10 plus these additional requirements:

- (A) A road work ahead (C23) sign instead of the shoulder work ahead (C24) sign on the shoulder upstream from the beginning of the auxiliary lane.

- (B) Cones on the shoulder stripe from the C23 sign continuously to the auxiliary lane line.
- (C) A land closed (C30) sign in the closed lane about 100 feet (30 meters) from its beginning and every 2,000 feet (600 meters) after that.

If the work site is a considerable distance from the beginning of the auxiliary lane and the above method is not practical, the lane shall be closed according to the Standard Plan T10. If the auxiliary lane is located at an exit ramp or connector, the closure plan in Standard Plan T14 shall be used.

8.27 Flagging Operations

Any time two-way traffic must share the same lane because of work in the other lane, a flagging operation must be set up. See Standard Plan T13.

Flaggers shall receive on the job training before going on duty and shall follow the flagging procedures described in the 1996 Caltrans Manual of Traffic Controls, Revision 1, Section 5-02.5, One Lane, Two Way Traffic Control and Section 5-04, Hand Signaling Control. They should be rotated and relieved periodically to maintain alertness.

In areas where flagger visibility is reduced, it is recommended that flaggers wear white coveralls and the proper warning garments as described in the Departmental Safety Manual, Chapter 12, Section 12.20. This will increase the flaggers' contrast with orange equipment and will make them more visible to approaching traffic.

On some two-lane roads one flagger may be used to control traffic. Traffic volume must be very light and the length of the one lane section should be short so that one end is visible from the other. The sight distance for approaching vehicles must be long enough that traffic can be safely controlled from one end of the work zone. This method must be approved by the Supervisor.

The cones on the centerline shown in Standard Plan T13 may be eliminated at the Supervisors' discretion if a pilot car is used. The pilot car shall have radio contact with personnel in the work area and the maximum speed of the pilot car through the traffic control zone shall be 25 miles (40 kilometers) per hour.

The minimum distance required between the flagger and the work area is listed in Table 1, Standard Plan T13.

Flaggers shall be used when the drivers vision is impaired because of smoke or dust in work zones. They shall also be used to protect trucks that must turn on the traveled way to load or dump. The flagging procedures in the 1996 Caltrans Manual of Traffic Controls, Revision 1, Section 5-02.5, One Lane, Two Way Traffic Control and Section 5-04, Hand Signaling Control shall be followed.

Where the end of a one-lane section is not visible from the other end, the flaggers shall maintain contact by means of radio or field telephones.

Except for unusual circumstances or emergencies, flaggers should not be used on freeways.

Traffic signals may be used to control traffic on two lane roads. The operation must conform to Section 9-03 of the Caltrans Traffic Manual.

8.28 Standard Exceptions to Lane Closure Procedures

(A) Limited Work on the Traveled Way, Without Lane Closures.

Short-term operations may be conducted on the traveled way without using a lane closure or signs. Pothole patching and debris retrieval, are examples of brief operations. To use this method all of the following conditions must exist:

- (1) The traffic volume must be light. This means the worker can walk from the shoulder to the site on the traveled way, do the job and walk back to the shoulder without interfering with traffic.
- (2) Sight distance shall be at least 500 feet (150 meters) in each direction. Where 500 feet (150 meters) of sight distance is not available at the work site, one or more lookouts may be posted to extend visual coverage.
- (3) Vehicles must be parked completely off the traveled way.

If all three of these conditions exist, the supervisor may instruct workers to perform the work on a specified section of highway without a lane closure. All of the following work methods shall be used:

- (a) When the crew consists of at least two workers, one of the workers shall act as a lookout. The lookouts exclusive duty will be to continually watch for approaching traffic and to warn the worker whenever trouble is suspected.
- (b) The lookout shall not carry a flag or paddle and shall do nothing to control or influence traffic. All workers shall be off the traveled way when traffic passes.
- (c) Only one production worker shall be on the traveled way, unless more are needed to reduce the exposure time.
- (d) Workers shall face approaching traffic whenever possible.

- (e) Workers shall have a planned escape route.
- (f) A FAS in the caution mode or a flashing amber light shall be operating.
- (g) Road Work Ahead (C23) signs are not required, since passing traffic is not to be affected.

(B) Pavement Marking and Relamping Operations

A supervisor may allow pavement marking and relamping operations on the traveled way without a lane closure. The posted speed limit must be less than 55 miles (88 kilometers) per hour and the work must take less than 10 minutes to complete. The supervisor may also use devices such as signs, barrier vehicles, and lookouts to increase worker protection.

(C) Chain Controls

Lane closures are not required in chain control operations. However, on multilane highways, they may be used to create a cushion between Caltrans workers and fast vehicles leaving the work area. In addition, a supervisor may use lookouts and barrier vehicles to increase worker protection.

(D) Moving Shoulder Operations

The supervisor may allow moving shoulder operations next to the traveled way without a lane or shoulder closure. Shoulder grading, mowing, and spraying operations are examples of moving shoulder operations. The work must leave at least 10 feet (3 meters) of the lane next to the shoulder open to traffic. On two lane conventional highways, traffic shall not be moved across the center stripe without a lane closure or other means of traffic control.

8.29 Moving Lane Closures

Any slow moving, unshadowed vehicle working in a freeway lane outside a lane closure shall have a TMCC and FAS or it shall be followed by a shadow vehicle. The only exceptions to this rule are tow trucks and snow removal/de-icing equipment.

Before employees work in a moving lane closure, a discussion should be held so that all involved employees will know what their role in the operation is and how to proceed safely.

For information on vehicle spacing, vehicle positioning, and signing refer to the Traffic Control System For Moving Lane Closure On Multilane Highways (T15 and T16) and on Two Lane Highways (T17).

All vehicles used as shadow trucks shall be equipped as defined in Section 8.12, Protective Vehicles. Radio communication in all vehicles is required.

Other requirements, for moving lane closures and shadowing moving operations, found in the Maintenance Code of Safe Operating Practices, shall be followed.

8.30 Shoulder Closures

Shoulder closures are used to guide motorists around stationary operations on shoulders. A shoulder closure is optional on unpaved shoulders and two-lane roads. It must be kept in mind that shoulder closures provide no physical protection.

A shoulder closure is required for a stationary operation on a multilane highway with a paved shoulder 8 feet (2.4 meters) or more in width whenever vehicles or equipment are parked on the shoulder within 6 feet (1.8 meters) of a traffic lane. Shoulder closures are to be set up as described on Standard Plans T10.

Shoulders used as part time lanes should be closed in the same way as lanes are closed.

A properly placed barrier vehicle shall be used with shoulder closures to protect workers.

8.31 Parking

Before a vehicle is parked, the driver shall consider if the vehicle will be needed to perform the work. If not, the vehicle should be used for the physical protection of workers. If it is used for protection, refer to Section 8.12, Protective Vehicles. If it will not be used for physical protection or for work, the vehicle shall be parked where it will not affect passing traffic.

All vehicles should be parked on the same side of the highway (see Section 8.20, Maintenance Crews Working Across From Each Other).

If a vehicle is parked on the shoulder within 6 feet (1.8 meters) of a traffic lane on a multilane highway with a paved shoulder 8 feet (2.4 meters) or more in width for more than 10 minutes then the shoulder must be closed as shown in Standard Plans T10. This is not necessary on city streets where parking is expected.

Whenever possible, a vehicle shall be entered and exited on the side away from traffic, even though

it may be harder to do so. This will reduce worker exposure. If possible, workers shall not stand or work near the back of vehicles. Also, whenever possible, workers shall not work directly in front of vehicles.

8.32 Night Work

Extra caution is necessary at night when both motorists and workers visibility is reduced.

Each employee must be informed about the hazards of working at night.

Careful planning is necessary and all the potential problems that may be encountered while working on or near the traveled way should be considered.

During the hours of darkness, workers on foot must wear the proper warning garments as described in the Departmental Safety Manual, Chapter 12, Section 12.20, and white coveralls. However, Supervisors should not require white coveralls in snow or fog areas where a mostly white background might lower worker visibility. Supervisors should not require white coveralls in weather requiring rain gear.

The rain gear jacket shall be reflectorized for nighttime wear. Reflective material may also be worn on hard hats.

Sufficient light should be provided at the work site. Light plants, floodlights, or work lights shall be mounted and directed in a manner to allow employees to work safely and to prevent glare to approaching traffic.

Because of the risk to workers, nighttime call outs should be kept to a minimum. If there is no danger to the public, repairs should wait until the next day. For example, if the damaged facility does not encroach on paved shoulder areas or is more than 3 feet (900 mm) from the traveled way in unpaved shoulder areas, there should not be a nighttime call out except to place barricades. It is up to the Supervisor to decide when it is appropriate to call out a crew for quick, temporary repairs or to wait until daylight.

Call outs should be made when warning or regulatory signs have been knocked down and pose immediate danger to the motorist. Also, Supervisors should consider responding at night for broken water lines, damaged phone or electrical lines, or spills where environmental damage may occur.

Each District will advise all local law enforcement agencies of this call out policy.

During nighttime lane closures, all traffic cones should be retro-reflective as described in the 1996 Caltrans Manual of Traffic Control, Section 5-05.6, Revision 1, Channelizing Devices.

If the one-piece solid, opaque sleeves are used for retro-reflection, they should be removed during daylight hours. If banded or transparent reflective sleeves are used, they can be left on the cone during daylight hours.

All warning signs used at night shall be made with high performance reflectorized sheeting.

During hours of darkness, the lights on the Flashing Arrow Sign shall be dimmed to prevent the halloing and blurring of the arrow image.

8.33 Working Equipment Against Traffic

Operating equipment against traffic is permitted when working on the shoulder or within a lane closure. This may be desirable in some cases. For example, during crack sealing operations, employees would have the added protection of the work vehicle between themselves and approaching traffic. Headlights shall be turned on during the daylight hours when working against traffic. They should be turned off at night when working against traffic because they might confuse motorists.

8.34 Operating Maintenance Equipment

Caltrans owns many types of equipment. Employees may be expected to operate anything from a sedan to a snow blower; from pruning shears to chain saws; and from hammers to powder actuated nail guns.

Supervisors should allow only trained employees to operate equipment. When a qualification program is in place for a given type of equipment, employees shall not operate equipment unsupervised, until, they have been qualified by the Department.

Trucks or other mobile equipment which leave a freeway lane, that is open to the public, to enter the construction area, shall slow down gradually in advance of the location of the turnoff to give following public traffic an opportunity to slow down. When leaving a work area and entering a roadway carrying public traffic, the equipment, whether empty or loaded, shall in all cases yield to public traffic.

All equipment shall be operated as designed by the manufacturer. All manufacturers' safety directions shall be followed.

Operators shall not repair equipment unless they have been properly trained to do so.

8.35 Tailgates of Trucks

Workers shall not use their hands or fingers to clear debris from the tailgates of dump trucks. They shall use a shovel, digging bar or other device to remove debris.

8.36 Compressed Air

Air under pressure, if not properly handled, can be hazardous. Air nozzles shall not be pointed at a worker's body to dust off clothing.

Tanks or drums shall not be filled with compressed air, if they were not, designed to be used as an air tank.

Air hoses shall be checked regularly to ensure that they are in good condition. Cracked or leaking hoses shall be removed from service and replaced. Compressed air tanks should be checked and drained weekly.

Compressed air-tank operating permits should be conspicuously displayed and kept current. Air tanks shall be inspected as required by the Unfired Pressure Vessel Safety Orders, §461.

All compressed air equipment and plumbing shall meet the requirements of the Unfired Pressure Vessel Safety Orders.

8.37 Working On Machinery And Equipment

Workers shall not work on electrical or mechanical equipment unless they are competent to do so.

Every power driven machine equipped with lockable controls or readily adaptable to lockable controls shall be locked out or positively sealed in the "off" position during repair, servicing or adjusting work. Machines not equipped with lockable controls or readily adaptable to lockable controls shall be de-energized or disconnected from its source of power. In all cases, accident prevention signs and/or tags shall be placed on the controls of the machines during repair work.

No one shall remove the tag or unlock the switch except the person who placed it.

During repair, machines or equipment shall be effectively blocked or otherwise secured to prevent inadvertent movement if such movement can cause injury to employees.

For example, before working underneath any vehicle and/or equipment to adjust or inspect it, steps shall be taken to ensure that the vehicle cannot move. Shut off the engine, set the brakes and physically block the wheels with wheel chocks before any work begins.

Remove the keys from the vehicle and place a 'Do Not Operate' tag in the ignition switch, on the steering wheel or some other very visible location. When working on a motor grader or other equipment that has implements such as blades, plows or buckets attached, you must lower them to the ground or block and/or chain them up before working underneath them.

Never get under a vehicle supported only by a jack. Use an approved safety stand designed to allow workers underneath the vehicle that is rated for the weight that they are expected to carry.

Do not work under a raised dump bed or other raised vehicle bed, unless the safety stand is in place. Raise the bed, place the stand in its holder and lower the bed onto the stand before beginning the work.

Depressurize air and hydraulic hoses before working on them. Do not search for hydraulic leaks with your hands; use a piece of wood or cardboard. Hydraulic fluid or air under pressure could enter your skin and cause serious injury.

Bleed pressure on spray tanks before opening or working on them. This includes chemical spray tanks, emulsion tanks on trucks or trailers, and even Hudson type pump sprayers.

Before adjusting, cleaning or repairing brush chippers, read the operators manual and take steps to ensure that all potential energized parts have been locked out. This includes the guillotine guards on those so equipped and all parts of the rotating drum.

This information is provided to help employees comply with the General Industry Safety Orders, §3314, Cleaning, Repairing, Servicing and Adjusting Prime Movers, Machinery and Equipment.

8.38 Work On Electrical Circuits

Only qualified persons shall work on electrical equipment or systems. All work performed directly on or in proximity to electrical installations, equipment or systems operating or intended to operate on systems of 600 volts or less shall comply with the Low Voltage Electrical Safety Orders. All work performed on systems operating at more than 600 volts shall comply with the High Voltage Electrical Safety Orders.

The Codes of Safe Operating Practices for work performed on electrical equipment or systems contain more information on the specific hazards and on the proper safety procedures to follow while performing the work.

This section does not apply to installations of conductors and equipment in vehicles, operating at less than 50 volts or to their ignition systems.

8.39 Working Near Utilities**(A) Overhead Utilities:**

Workers shall not be required or permitted to perform any function in proximity to energized high voltage lines. Any activity where any parts of tools, machinery, materials or any part of an employee's body will come closer than the minimum clearances from energized overhead lines set forth in the following table is prohibited.

Boom equipment must not be operated where the boom could come within the minimum required clearance set forth in this table. Hoisting over energized lines is prohibited.

Nominal Voltage (Phase to Phase)	Minimum Required Clearance (Feet)	Minimum Required Clearance (Meters)
600.....50,000	10	3
Over 50,00075,000	11	3.4
Over 75,000125,000	13	4
Over 125,000. ..175,000	15	4.6
Over 175,000.. .250,000	17	5.2
Over 250,000... 370,000	21	6.4
Over 370,000.... 550,000	27	8.2
Over 550,000...1,000,000	42	12.8

Figure 8-2: Overhead Utilities

Any overhead conductor shall be considered to be energized unless and until the person owning or operating such line verifies that the line is not energized and the line is visibly grounded at the work site.

If downed power lines are located, workers shall not try to move or repair them. They shall stay clear and call the experts; normally, the local power company will respond.

(B) Underground Utilities:

Before any digging or excavations are begun, the area shall be checked to determine if there are any buried utilities. Some examples of digging or excavations requiring checking would be installing a new sign post, guide marker, snow pole, shoulder grading or ditch/culvert cleaning. Utility markers or buildings that have no above ground source of power can indicate underground utilities. If the excavation will be conducted in an area, which is known, or reasonably should be known, to contain subsurface installations, only hand tools shall be used for digging.

The Superintendent or Supervisor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to commencing any excavation with power tools.

The regional notification centers include but are not limited to the following:

<u>Notification Center</u>	<u>Telephone</u>
Underground Service Alert Northern California (USA)	1-800-642-2444
Underground Service Alert Southern California (USA)	1-800-422-4133
South Shore Utility Coordinating Council (DIGS)	1-800-541-3447
Western Utilities Underground Alert, Inc.	1-800-424-3447

If the excavation will be conducted in an area which is known, or reasonably should be known, to contain Caltrans electrical facilities, the Superintendent or Supervisor shall notify the Electrical Supervisor for the area, prior to commencing any excavation.

8.40 Confined Spaces

Workers need to be aware of confined space hazards.

A confined space is any location that meets the following definition:

- 1) an employee can physically enter, and
- 2) has limited or restricted means of entry or exit, and
- 3) is not designated for continuous employee occupancy.

For Caltrans employees, confined spaces include structures or facilities such as tanks, bridge cells, shafts, pits, bins, tubes, pipelines, deep trenches, vaults, vats, pump houses or compartments, sewage lift stations, culverts, cofferdams, elevator pits, or similar locations.

No person will be allowed to enter a confined space unless all workers involved have been trained in the operating and rescue procedures and have reviewed the Departmental Safety Manual, Chapter 14, Confined Spaces and the Maintenance Code of Safe Operating Practices, Appendix B, Confined Space Entry Procedures. Supervisors must ensure workers are properly trained and have read this material and understand it.

All employees who are designated as hands on users of instruments for testing for hazardous gases and oxygen deficiency must be trained in Confined Space Safety every 2 years.

8.41 Trench And Excavation Safety

Employees shall review the Maintenance Code of Safe Operating Practices, Appendix D, Trench and Excavation Safety Guidelines before working in or near trenches or excavations. Supervisors shall ensure employees understand and follow these guidelines.

Caltrans workers shall not enter any trench or excavation that has been dug by others until a supervisor or superintendent has inspected the trench/excavation and the surrounding area to identify and/or correct any hazards. The supervisor or superintendent must be competent and knowledgeable about soil classification, shoring/sloping techniques and requirements, access requirements, and the hazards of underground work.

If there is any doubt about the safety of an excavation, an engineering opinion shall be obtained before any work starts.

All work in trenches/excavations shall comply with the Construction Safety Orders, Article 6, Excavations.

8.42 Ladders

Ladders shall be maintained in good condition at all times, the joint between the steps and side rails shall be tight, all hardware and fittings securely attached, and the movable parts shall operate freely without binding or undue play.

Metal ladders shall not be used while working on electrical equipment. All metal ladders shall be marked with a sticker or stencil that clearly says: 'Caution-Do Not Use Around Electrical Equipment'.

Supervisors shall periodically inspect ladders for wear and damage. All ladders shall be cleaned of oil, grease, or slippery materials. Ladders which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as 'Dangerous, Do Not Use'.

8.43 Handling Hazardous Substances

See Chapter D5, the First Responder Operations Reference Manual, and the Maintenance Hazardous Waste Manual for more information on this subject.

8.44 Radioactive Incidents

See Chapter D5 - Spills of Substances on Highway Rights of Way and the First Responder Operations Reference Manual.

8.45 Chemicals

See Chapter C2 - Vegetation Control, and Chapter D5 - Spills of Substances on Highway Rights of Way, for details on this subject.

8.46 Explosives

Care in handling and storing explosives are specified in Chapter 5 - Blasting.

8.47 Use of Reclaimed Water

Before employees use reclaimed water, they shall be told about the potential health hazards involved with contact or accidental ingestion of reclaimed water. They shall also be trained how to properly clean up after using it.

Reclaimed water must meet applicable coliform and health standards before, it can be used by Caltrans personnel, for irrigation, or dust control. The county health department shall be contacted for guidance.

Contact with reclaimed water shall be kept to a minimum. Workers shall use impermeable (rubber) gloves and appropriate protective clothing. Supervisors should contact the local supplier to determine what other specific precautions should be taken.

Employees must have clean water and soap available at the work site when using reclaimed water. Workers shall be instructed to wash their hands thoroughly before eating, drinking, smoking, or going to the bathroom.

More information on the use of reclaimed water is found in the Maintenance Code of Safe

Operating Practices.

Refer to the attached pages for the Standard Plans

APPENDIX	T10 - Traffic Control System For Lane Closure on Freeways and Expressways
APPENDIX	T10A - Traffic Control System For Lane And Complete Closures on Freeways and Expressways
APPENDIX	T11 - Traffic Control System For Lane Closure on Multilane Conventional Highways
APPENDIX	T12 - Traffic Control System For Lane Closure on Multilane Conventional Highways
APPENDIX	T13 - Traffic Control System For Lane Closure on Two Lane Conventional Highways
APPENDIX	T14 - Traffic Control System For Ramp Closures
APPENDIX	T15 - Traffic Control System For Moving Lane Closure on Multilane Highways
APPENDIX	T16 - Traffic Control System For Moving Lane Closure on Multilane Highways
APPENDIX	T17 - Traffic Control System For Moving Lane Closure on Two Lane Highways

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL	SHEET NO.	TOTAL SHEETS

Caltrans

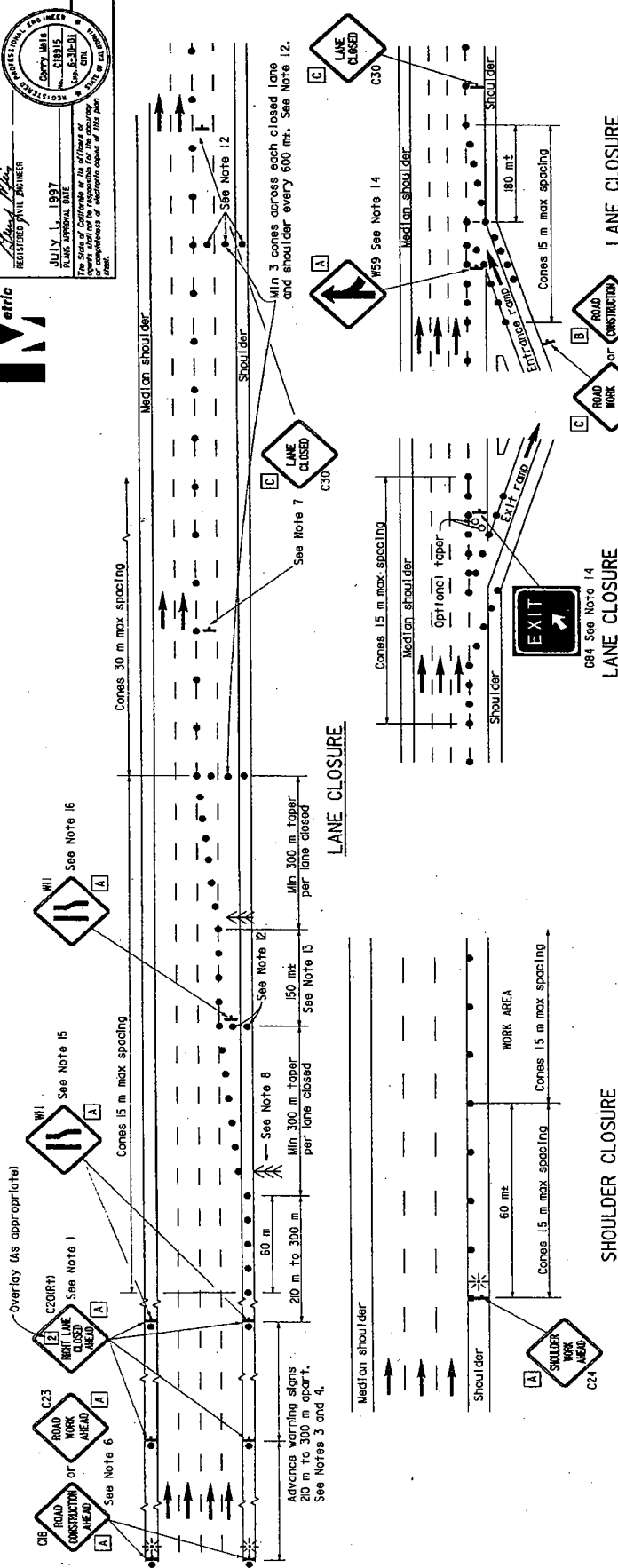
etrio

REGISTERED CIVIL ENGINEER

AUG 11, 1997

PLANS APPROVAL DATE

The State of California is the official seal of the State of California and the State of California is the official seal of the State of California.



NOTES

1. Median lane closures shall conform to the details for outside lane closures except that C20 (L) signs shall be used.
2. Not less than one person shall be assigned to full time maintenance of traffic control devices on all night lane closures or day-time closures exceeding 15 km in length, including taper.
3. Duplicate sign installations are not required on opposite shoulder if at least one-half of the available lanes remain open to traffic.
 - a) In the median if the width of the median shoulder is less than 2.4 m and the outside lanes are to be closed.
 - b) Advance warning sign installations shall be equipped with flags for daytime closures.
4. All advance warning sign installations shall be fitted with reflective sleeves as specified in the specifications.
5. A C3 "END WORK" sign, as appropriate, shall be placed at the end of the lane closure unless the end of work area is obvious or ends within a larger project's limits.
6. If the C8 (or C23) sign would follow within 100 m of the C20 (L) sign, the C20 (L) sign shall be placed in the "STATE HIGHWAY CONSTRUCTION AHEAD" sign.
7. Place a C30 sign every 600 m throughout length of lane closure.
8. One flashing arrow sign for each lane closed. The first flashing arrow sign shall be Type 1. All others may be either Type 1 or Type 11.
9. A minimum 450 m of sight distance shall be provided where possible for vehicles approaching the first flashing arrow sign. Lane closures shall not begin at top of crest vertical curve or on a horizontal curve.
10. All cones used for night lane closures shall be fitted with reflective sleeves as specified in the specifications.
11. Portable delineators, placed at one-half the spacing indicated for traffic cones may be used in lieu of cones for daytime closures only.
12. Unless otherwise specified in the special provisions, the 604 and W55 signs shall be used as shown.
13. Unless otherwise specified in the special provisions, the 50 m section of the lane closure shown along lane lines shall be used between the 300 m lane closure tapers when two or more adjacent traffic lanes are to be closed.
14. Unless otherwise specified in the special provisions, the 604 and W55 signs shall be used as shown.
15. Where specified in the special provisions, a W1 "LANE REDUCTION SYMBOL" sign is to be used in place of the C20 "RIGHT LANE CLOSED AHEAD" sign.
16. The W1 "LANE REDUCTION SYMBOL" sign shown at this location is to be used where the W1 sign is used as advance warning as described in Note 15.

SIGN PANEL SIZE (mm)

A	1200 mm x 1200 mm
B	900 mm x 900 mm
C	750 mm x 750 mm

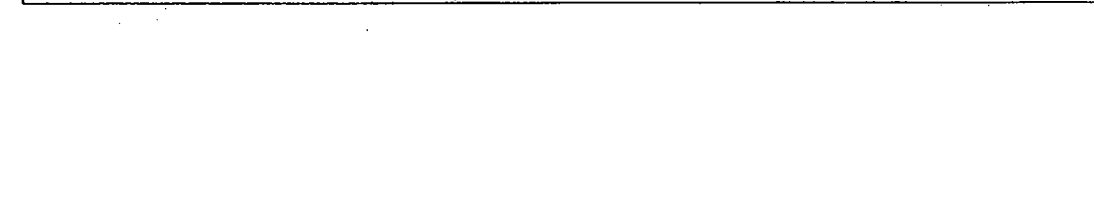
LEGEND


- Traffic Cone
- Traffic Cone (optional taper)
- ↑ Portable Sign
- ⇐ Flashing Arrow Sign
- Direction of Travel
- ✱ Portable Flashing Beacon

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

TRAFFIC CONTROL SYSTEM
FOR LANE CLOSURE ON
FREEWAYS AND EXPRESSWAYS

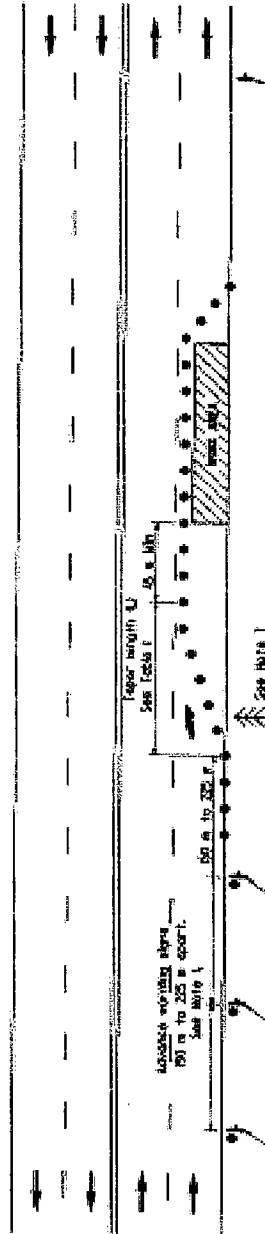
NO SCALE



Project Name	Sheet	Scale	Date
State of California	1011	1/4" = 1'-0"	10/1/71
			
Approved for Construction Date: 10/1/71 By: [Signature] Title: [Title] Department of Transportation Division of Highways			



TYPICAL LANE CLOSURE



SIGN PANEL SIZES (INCHES)

- 1 900 mm x 900 mm
- 2 600 mm x 450 mm
- 3 900 mm x 450 mm
- 4 750 mm x 750 mm

LEGEND

- Traffic Sign
- † Portable Sign
- Direction of Travel
- ↔ Parking Area Sign

NOTES

1. Where approach roads are less than 100 feet wide, signs shall be placed at 100 feet from the end of the approach road.
2. An advance warning sign shall be placed at the end of the approach road, and a 'ROAD CLOSED' sign shall be placed at the end of the approach road.
3. A 'ROAD CLOSED' sign shall be placed at the end of the approach road, and a 'ROAD CLOSED' sign shall be placed at the end of the approach road.
4. If the 'ROAD CLOSED' sign is placed at the end of the approach road, it shall be placed at the end of the approach road.
5. An advance warning sign shall be placed at the end of the approach road, and a 'ROAD CLOSED' sign shall be placed at the end of the approach road.

TABLE 1

Approach Road Length (ft)	Number of Signs (per lane)	Spacing of Signs (ft)
0-100	2	25
100-200	3	25
200-300	4	25
300-400	5	25
400-500	6	25
500-600	7	25
600-700	8	25
700-800	9	25
800-900	10	25
900-1000	11	25

Based on 15 ft wide lane, this column is only applicable for lane width less than 15 ft.

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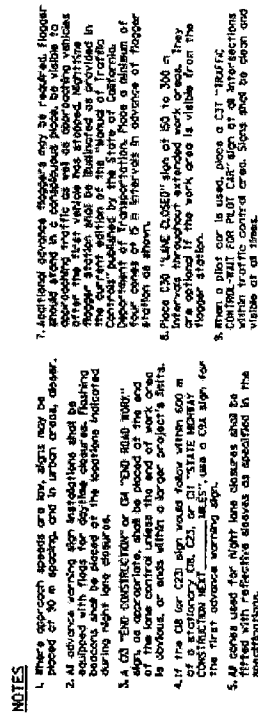
TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE ON MULTILANE CONVENTIONAL HIGHWAYS

NO SCALE



TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE ON TWO LANE CONVENTIONAL HIGHWAYS

186



Approximate Speed (km/h)	# of Cars
0-30	60
50-70	90
over 70	150

an increase by 20 percent on sustained-downgrades steeper than 3 percent and longer than 16 km.

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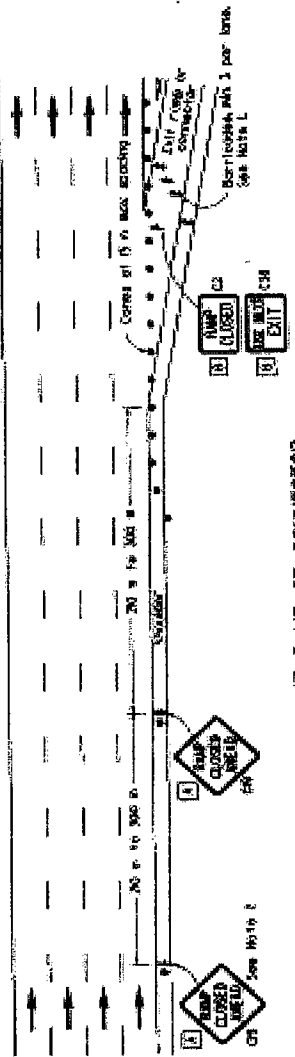
TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE ON TWO LANE CONVENTIONAL HIGHWAYS

**TRAFFIC CONTROL SYSTEM
FOR RAMP CLOSURE**
 NO SCALE

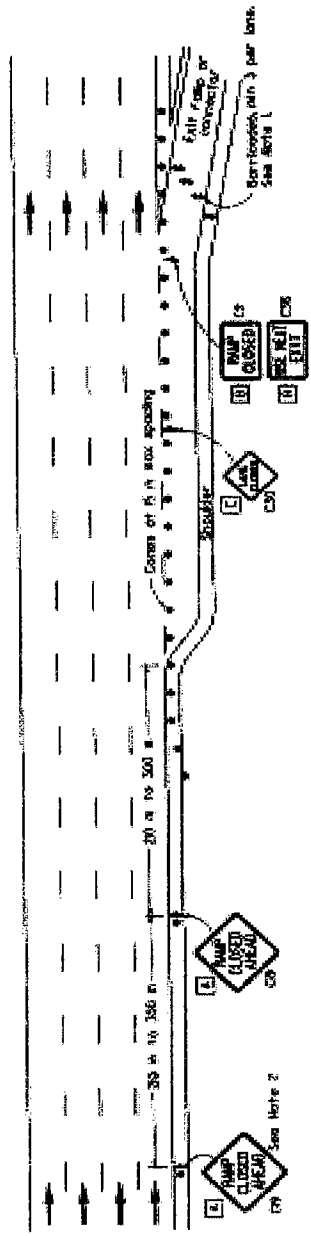
NOTES
 1. Barricades shall be Type 4, 11, or 111 for closures lasting one week or less and Type 111 for closures lasting longer than one week.
 2. In the case of placing the "RAMP CLOSED AHEAD" and "RAMP CLOSED" signs, back on advance warning signs with the word "AHEAD" may be mounted, as directed by the Engineer, on all guide signs that refer to the closed ramp. The letter size on the advance sign shall be the same as the guide sign.
 3. All advance warning sign installations shall be equipped with flags for daytime devices.
 4. All cones used for night time closures shall be fitted with reflective sheeting as specified in the specifications.
 5. Portable vehicles, placed at intervals the spacing indicated for traffic cones, may be used in lieu of cones for daytime ramp closures only.
 6. During nighttime ramp closures, at least one person shall be assigned full time for maintenance of traffic control devices.

SRM PANEL SIZE (MM)
 4 400 mm x 200 mm
 5 400 mm x 150 mm
 6 150 mm x 150 mm
 7 300 mm x 300 mm
 8 900 mm x 600 mm

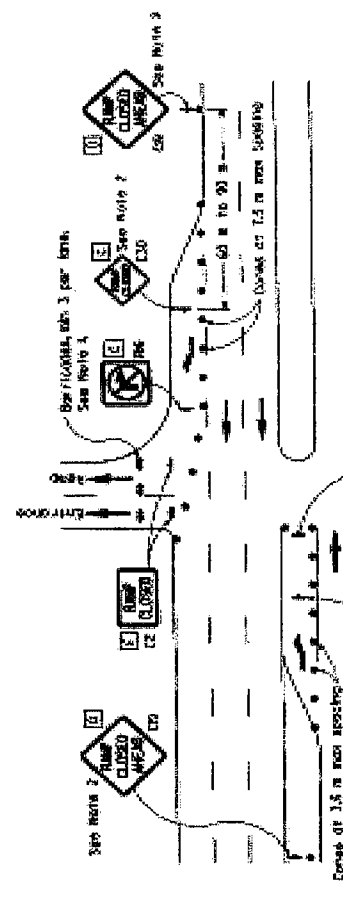
TYPICAL RAMP CLOSURES



EXIT RAMP OR CONNECTOR



EXIT RAMP OR CONNECTOR WITH ADDITIONAL LANE

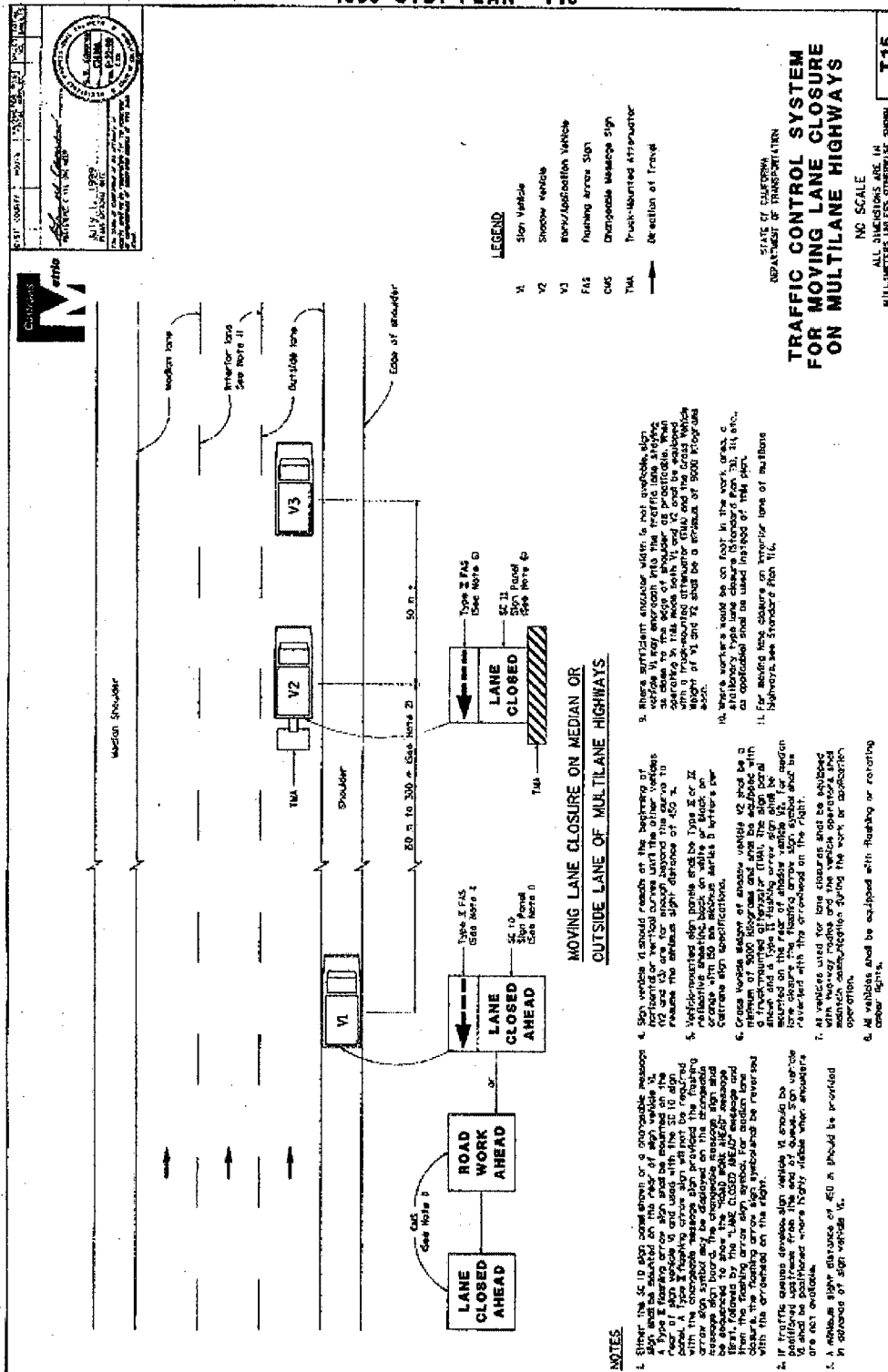


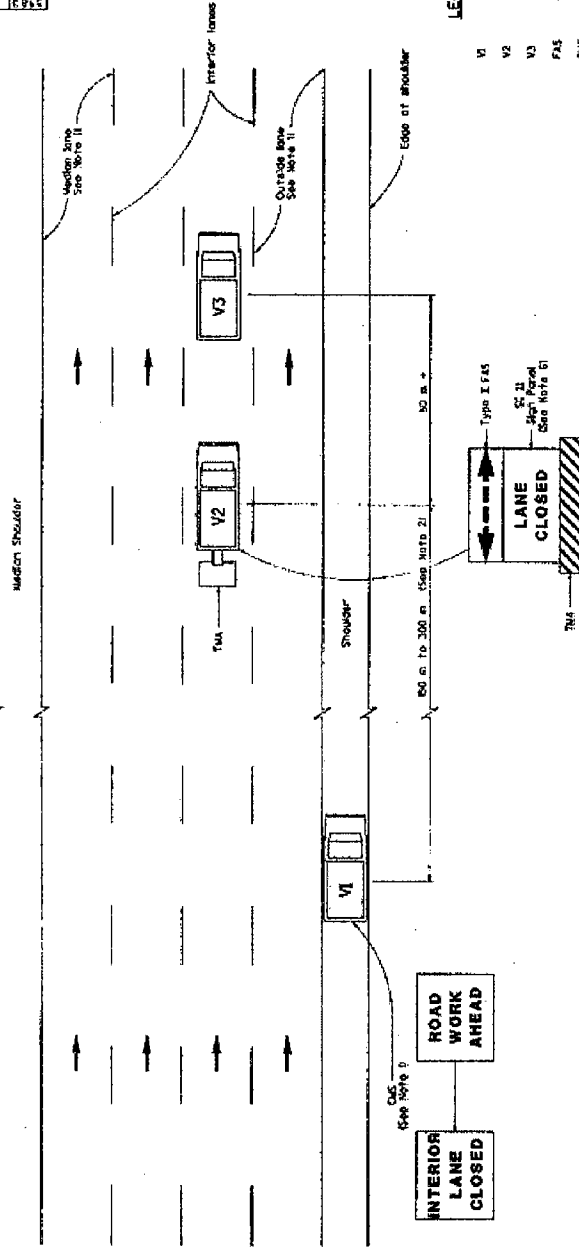
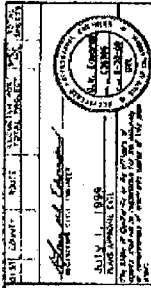
ENTRANCE RAMP WITHOUT TURNING POCKETS



ENTRANCE RAMP WITH TURNING POCKETS







LEGEND

- V1 Sign Vehicle
- V2 Stopped Vehicle
- V3 Work/Assignment Vehicle
- FAS Flashing Arrow Sign
- CMS Changeable Message Sign
- TMA Truck-Mounted Attenuator
- Direction of Travel

NOTES

1. Changeable message sign shall be located at the rear of sign vehicle V1, the changeable message sign and be sequenced to show the "ROAD WORK AHEAD" message first, followed by the "INTERIOR LANE CLOSED" message. The "INTERIOR LANE CLOSED" message shall be used in place of the "ROAD WORK AHEAD" message.
2. If traffic control system sign vehicle V1 should be positioned upstream from the end of work area. Sign vehicle V1 and be positioned where highly visible when shoulders are not available.
3. A minimum sight distance of 50 m should be provided in advance of sign vehicle V1.
4. Sign vehicle V1 should remain at the beginning of horizontal or vertical curve until the other vehicles have cleared the work area and the curve to remove the advance sight distance of 50 m.
5. Vehicle-mounted sign boards shall be Type III or IV reflective material with 200 mm minimum letters per California sign specifications.
6. Gross vehicle weight of shadow vehicle V2 and be a minimum of 3000 kilograms and shall be equipped with a minimum of 2000 watts of flashing arrow light and be placed on the rear of shadow vehicle V2. For margin lane closure the flashing arrow sign symbol shall be reversed with the arrowhead on the right.
7. All vehicles used for lane closures shall be equipped with truck-mounted attenuators (TMA) and shall maintain communication during the work or application operation.
8. All vehicles shall be equipped with flashing or rotating amber light.
9. Where sufficient shoulder width is not available, sign vehicle V1 shall be positioned on the shoulder as practical, then on close to the edge of shoulder as practical. Then sign vehicle V1 and V2 shall be equipped with a truck-mounted attenuator (TMA) and the Gross Vehicle Weight of V1 and V2 shall be a minimum of 3000 kilograms each.
10. Where workers would be on foot in the work area, a temporary free zone closure standard Plan T16, T17, and T18 shall be used.
11. For moving lane closure on median or outside lanes of multilane highways, see Standard Plan T13.

TRAFFIC CONTROL SYSTEM FOR MOVING LANE CLOSURES ON MULTILANE HIGHWAYS

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

NO SCALE
ALL DIMENSIONS ARE IN
MILLIMETERS UNLESS OTHERWISE SHOWN

Appendix B

FIELD FORMS

**Caltrans SR-73 1085L GSRD with Sediment Trap 2002-2003 Monitoring
During Storm Field Data Log Sheet**

GENERAL INFORMATION:

Date:	Julian day:	Time:
Team leader's initial:		Stormwater consultant: CDM
Site ID and Sampling Location:		

METEOROLOGICAL CHARACTERISTICS:

Present rainfall: ☐ None ☐ Intermittent
☐ Light (averaging < 0.5 mm/hour (0.02 inch/hour))
☐ Moderate (averaging ~ 0.5-1.75 mm/hour (0.02-0.07 inch/hour))
☐ Heavy (averaging > 1.75 mm/hour (0.07 inch/hour))

Meteorological characteristics comments:

FIELD CONDITIONS/GSRD PERFORMANCE:

Check all that apply and describe under comments.

Depth of water: _____

Overtopping Downstream Weir? ☐ Yes ☐ No ☐ Explain: _____

Odor: ☐ None ☐ Hydrogen Sulfide ☐ Musty ☐ Sewage ☐ Ammonia
☐ Hydrocarbon ☐ Pest/Herbicide ☐ Other: _____

Deposits: ☐ None ☐ Sediments ☐ Rust ☐ Stains (color): _____
☐ Trash (list): _____
☐ Organic Debris ☐ Other: _____

Sediments: ☐ None ☐ Yes
Approximate length _____; width _____; height _____

Biological: ☐ None ☐ Rodents ☐ Birds ☐ Reptiles
☐ Insects ☐ Other: _____

Vegetation: ☐ None ☐ Normal ☐ Abnormal: _____ Type: _____

Floating Materials: ☐ Not applicable, no water ☐ Oil & Grease, see above ☐ Trash
☐ Surface Film ☐ Sewage ☐ Organic Debris ☐ Other: _____

**Caltrans SR-73 1085L GSRD with Sediment Trap 2002-2003 Monitoring
During Storm Field Data Log Sheet**

Provide a description of the site activities and nearby activities:

FIELD CONDITIONS/GSRD PERFORMANCE: (continued)

Describe traffic conditions:

Comments:

(Team Leader's Signature)

**Caltrans SR-73 1085L GSRD with Sediment Trap 2002-2003 Monitoring
Post-Storm Field Data Log Sheet**

Site Name: _____

Date: _____

Julian Day: _____

Time: _____

Team Leader: _____

Field Team: _____

Stormwater
Consultant: **CDM**

Time since end of previous storm event: ☐ > 72 hrs ☐ > 48-72 hrs ☐ > 24-48 hrs ☐ < 24 hrs

Meteorological characteristics comments: _____

Is the GSRD screen free from major clogging? ☐ yes ☐ no

If no, cause of clogging: _____

Is the Sediment Trap screen free from major clogging? ☐ yes ☐ no

If no, cause of clogging: _____

Standing water? ☐ yes ☐ no ☐ Depth: _____

If yes, explain: _____

Does the device need to be cleaned? ☐ yes ☐ no

Visual Gross Solids Measurement:

Approximate volume of gross solids captured by GSRD screen:

Approximate volume of gross solids in sedimentation trap area:

Visual Assessment (% full):

Gross Solids Characteristics:

	Yes	No
Paper	<input type="checkbox"/>	<input type="checkbox"/>
Plastic	<input type="checkbox"/>	<input type="checkbox"/>
Cardboard	<input type="checkbox"/>	<input type="checkbox"/>
Glass	<input type="checkbox"/>	<input type="checkbox"/>
Metal	<input type="checkbox"/>	<input type="checkbox"/>
Styrofoam	<input type="checkbox"/>	<input type="checkbox"/>
Cigarette butts	<input type="checkbox"/>	<input type="checkbox"/>
Wood	<input type="checkbox"/>	<input type="checkbox"/>
Cloth	<input type="checkbox"/>	<input type="checkbox"/>
Sediment	<input type="checkbox"/>	<input type="checkbox"/>
Organic Debris	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>

Odor:

	Yes	No
Rotting	<input type="checkbox"/>	<input type="checkbox"/>
Sulfur	<input type="checkbox"/>	<input type="checkbox"/>
Metallic	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>

If Other, Explain: _____

Explain: _____

Comments: (site conditions, equipments, etc.)

(Team Leader's Signature)

**Caltrans SR-73 1085L GSRD with Sediment Trap 2002-2003 Monitoring
Post-Storm Gross Solids Field Measurement Data Log Sheet**

Site Name: _____

Date: _____

Julian Day: _____

Team Leader: _____

Time: _____

Field Team: _____

Stormwater Consultant: **CDM** _____

Time since end of previous storm event: ☐ > 72 hrs ☐ >48-72 hrs ☐ >24-48 hrs ☐ < 24 hrs

Meteorological characteristics comments: _____

Captured Gross Solids Measurement:

(Upstream (GSRD) Area)

Wet Weight of Gross Solids (kg)

Wet Volume of Gross Solids (m³)

Sample 1	Sample 2	Sample 3	Sample 4	Sample 5

Settled Gross Solids Measurement:

(Downstream (Sediment Trap) Area)

Wet Weight of Gross Solids (kg)

Wet Volume of Gross Solids (m³)

Sample 1	Sample 2	Sample 3	Sample 4	Sample 5

Comments: (site conditions, equipments, etc.)

(Team Leader's Signature)